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EDITORIAL NOTES.

Coal Prices and Gas Purification.

FAR and away in general importance stand, amid the components of the speech of Mr. Charles Carpenter, D.Sc., to the proprietors of the South Metropolitan Gas Company last Wednesday, the subjects of coal prices and purification. The success of the Company's operations in the half year, coming out as they did with a balance on the right side, evoked the ordinary evidences of a general satisfaction; as did many of the other points that the Chairman made, and made with the eloquence and weight of a complete confidence. But the two points of coal and purification, in all their bearings, stand in striking relief from other matters of a more or less domestic nature, if anything that affects a *quasi*-public enterprise can be so termed. The accounts of the Company have shown how, despite all that has been done to garner-in the economies of skilled direction and working and to enlarge the business, the margin has been a narrow one between, on the one hand, income at the present price of gas and good residuals markets and, on the other, the full discharge of obligations; and it is not therefore very surprising to hear that more than once in these times the Directors have seriously discussed the question of raising the price of gas. But ever and again, the same result; the price has not been raised. In this repeated result is read a large part of the history and policy of the management of the concern. It has tried hard to maintain the *rôle* of a low-price concern that never retraces its steps to higher than current charges except by absolute compulsion; and each time that the prospect of raising the price has been before the Board, there has been a resolve to make one more try, and it has always been successful.

The fact that there has been this consideration of the question of raising the price is significant; the fact that the price has not been raised is also significant of resolution and courage. Nor is there any intention of increasing the price at the present time; and there is hard working to maintain unharmed the triple interests of consumers, proprietors, and co-partners. But it is patent that, under certain conditions, this sort of thing could not go on for ever. If there was a further ascent of coal prices, or no easing of coal prices with a falling away of residual values, the position of the Company would demand a change in the price of 2s. 2d.; and thus consumers, proprietors, and employee proprietors would all have to suffer. But this is not a matter for the moment. The maintenance of the present price, or its increase, rests in the lap of the future—coal being the determining factor. There are some people who treat lightly the increasing of the price of gas by such a Company trading in a comparatively poor neighbourhood. One proprietor at the meeting, confessedly interested in both coal and gas, spoke of a penny increase in the charge for the latter representing a revenue of about £56,000 a year; and yet the incidence of an increase of the kind did not strike him as being a matter of some individual importance. It means taking £56,000 out of the pockets of the people of, in the major part, a comparatively poor residential class area—anyway, in all the inner districts it is a massed poor population that is screened by the shop-lined main streets. It means, too, the reduction of the participation in the profits by the Company's employees, to say nothing of the partial lowering, under the sliding-scale, of the dividends of the ordinary proprietors. The penny increase in the price of gas represents, by very many thousands of pounds, a lessened spending power in the Company's area. While we do not believe in going to unreasonable lengths, we can well understand the Chairman and the Board hesitating time after time to raise the price, and making still further effort to keep to the figure of 2s. 2d., which has been such a boon to South London, and has given to the Company the strong foundation and protection that they there possess.

The pity of it is the coal industry does not look upon the gas industry as kindred to itself. In the main, the gas industry is solely dependent on coal as its raw material; and it is in effect one of the biggest distributing agents of all that coal possesses. It is to the interest of the coal owners to assist, rather than to oppress, the gas industry. The gas industry is likewise allied, through interests in common, with the colliery coke-oven industry. The gas industry asks for no particular favour, but there is abundant evidence of a tangible nature that the colliery owners do inflict upon the gas industry the top weight of the burdens that they can apply above what is fair and consistent with the laws ordinarily governing trade. The understandings and agreements that exist in the coal trade are practically conspiracies to maintain undue burdens. The colliery owners may not like the truth in such plain language; but that is practically what it amounts to. Mr. Carpenter speaks of the law of supply and demand as a factor in the situation; and he also emphatically dwells upon the growth of the export trade in coal, and particularly from those northern fields from which the gas industry draws such a large part of its supply. In the export trade, he finds the weapon that the colliery owners effectually wield in extracting higher prices from home buyers; and so again Mr. Carpenter raises the point as to the duty of the Government to inflict restrictions by means of a tax on exported coal. We are quite in entire accord with Mr. Carpenter in this matter; just as he follows in regard to it his old chief, Sir George Livesey, and is in sympathy with the views upon it held by Sir Corbet Woodall. He goes further now, and suggests a tax on exported coal and the tax-free export of metallurgical coke, for reasons which are of sufficient interest to cause readers to turn to the report of the speech itself to see their exact terms. But at the same time, the events since the coal strike are shaking our belief in an export tax (by all means let there be one if it can be obtained) playing any important efficacious part in the regulation of prices at home. The coal owners have found their strength—we will not say in rigid combination, but in those subterranean understandings that have much the same effect, as the gas industry to-day knows to its cost. To get to the very root of this matter, it will be necessary to strike deeper than would be the case solely by a reimposition of the coal tax; and no one can strike to the depth requisite but the Legislature, through the process of statutory control, against which there would at once be raised opposition on economic grounds. But the present position—the excess of home prices for coal above all that is reasonable and fair—is also hostile to the economic interests of the country. Of the alternatives, give us the statutory control which would again compel the opening-up of free competition in coal, which there is not to-day with ruling prices dominated, within limits, by understandings if not in express terms, sufficiently so to command very close adherence.

It is said that there are signs of slackening prices; various chairmen of gas companies have said this during the past few days. From the side of the coal industry, there does not come much support for the hope. However, that the hope may mature is the general wish of the gas industry; but the experiences of the past two years prompt the belief that, without some statutory regulation is applied to our primary native product, opportunities will not be allowed to slip by the coal owners for sweating industry in the way they have been doing so effectually of late. It would indeed be a hard thing for an industry such as gas supply to find that all the product of its restless activity in working for economy, for greater effect from its technical operations, and for expansion of business, was ever being swallowed up by the higher costs of raw material, as it has been during, at any rate, the past two years; and that through one thing and one thing alone—cost of coal—the financial position

had assumed practically a settled state, except perhaps in areas that were undergoing large new developments. Therefore, though the foundations for the hopes as to coal prices breaking-down to lower point are not at the moment over-substantial, we trust they will prove true.

There is the question of purification under the catalytic process that has been developed at the South Metropolitan Gas-Works. The process, it is again reported, is a technical success both in operation and result; and the large plant that is being constructed at East Greenwich will only cost about half the amount per unit of capacity that the Old Kent Road plant did, and it is possible to see where and how greater fuel economies can be realized. The Chairman in his references to the plant established a connection between it and the purchase of coal. Generally speaking, present deliveries of coal contain more sulphur than formerly; but with this new plant it is found that it does not matter how sulphurous the coal, the finished gas is of a purity greater than anything hitherto attained. This being so, the new purification process will give the Company greater liberty in the coal markets. The point is of interest; for the fact needs no accentuating, that the wider the available selling markets the greater the influence on the side of the buyers. We have only touched on two or three of the matters in an interesting multi-featured address.

The Industry's Present, and Gas-and-Air Distribution.

"THERE are some people who are of opinion that the gas "industry has now reached its zenith." These words are found in the early part of the interesting and broad-minded Presidential Address that Mr. W. H. Roberts, of Newtownards, delivered to the Irish Association of Gas Managers on Tuesday last. It is only in the nature of things that there should be found pessimistic people in all grades of the social fabric, or people holding pessimistic opinions in relation to a particular subject. But it must be said that the pessimists in this matter of the gas industry form an insignificant counterpart to the optimists, as is seen by the strong position the industry holds in the stock markets. The industry itself, in its progressive constructive work, offers the strongest opposition to pessimism in relation to its affairs obtaining any serious hold. It would be, as Mr. Roberts points out, a bad thing for the industry if those holding power in its administrative work were, like the councillor mentioned in the address, to begin to entertain such fears as to the future that the industry was crippled by denying to it necessary capital expenditure. But, thank goodness, the survey we are able to make of gas affairs does not upset the serenity of our feeling that such lugubrious notions are not in the ascendant. The contrary is in reality the case; and we feel ourselves almost convicted of wasting time and space in referring at all to the matter.

However, for the moment, we would address ourselves to the few pessimists that there may be in the ranks of our local governing bodies with voice in the granting of spending powers to gas undertakings. Reference has already been made to the position of the gas industry in the money market, which shows the confidence of investors. The confidence is justified. The gas industry occupies a strong position in the trading markets of the world; and it provides not only gas, but several other necessaries, which give to it an inherent strength not possessed by its rivals. Its prospects are great. Its services in relation to its primary product have developed from the single one of providing light to others that hold the promise of a greater progress in service and convenience than the single one with which the pioneers of its enterprise launched out. In respect of this single one of lighting, science is, according to the present system of utilizing gas, a quality in regard to the composition of the light that stands superior to that of its chief competitor. Supplementing all this, the conditions of the present—not only the competitive ones, but those controlling the markets for materials, and the fresh applications of gas, which can only be developed by persistent contention with opposing forces—have put the men of the gas industry on their mettle, with the result that there was never a stronger wave of energy passing through the industry, nor greater economic working ruling advance, than at the present time. There are advantages over competitors, in that the raw material is put to the greatest economic use, and upon the primary product there is not sole dependence. And, furthermore, the primary product contains in it more value for the user than does its chief competitor. Considering all these things, where is the room for pessimism even among a few members of local authorities controlling gas undertakings? If they will only take a proper survey of the actualities of the position, they must, even although their present inclination be hostile, see things in an altogether new light, and their enrolment among the optimists and the sentient in this particular matter will be only a question of brief time.

There are two technical subjects of controversial nature in the address. The one refers to the employment of vertical retorts in small gas-works; and the other to a matter affecting distribution. Whether vertical retorts or horizontal ones should be adopted by small works is a question that must be decided entirely by local circumstances. That they can be adopted with considerable advantage by small works has been shown by illustration in our columns from Ireland itself, through the article by Mr. Wilfred Tallentire, of Lurgan, published on May 6 last. Mr. Roberts, however, in his Presidential Address, shows that he is "sitting on the "fence" in regard to them. At the present time, he cannot see that there is anything more in verticals than a slight saving in the matter of labour; yet he believes that it is the carbonizing system of the future. His vision, however, is directed by his present circumstances at Newtownards; and in his current Newtownards view he is unquestionably correct. The question of the adoption of verticals must be subservient in every case to present conditions; and if the conditions prescribe a small extension of the present horizontal retort plant as being all that is necessary, then it would indeed be folly to sacrifice the settings in order to put up verticals.

The matter, however, of greatest technical and discussable interest is Mr. Roberts's views as to the future of distribution. He foretells "drastic changes in the present "methods of distribution, whereby the ordinary consumer "will, with his present fittings, be able to obtain about "double the lighting efficiency under existing conditions." This is attractive. The opinion of the President is that this is to be accomplished by the distribution of a gas-and-air mixture through the ordinary mains at about 10 inches pressure, after the plan favoured by the "Selas" lighting system; and, what is more, Mr. Roberts has been carrying out work on his high-pressure and low-pressure distribution mains with this ultimate object in view. The first consideration is what advantage this proposal is going to confer on the gas consumer. Under the "Selas" system about 2 volumes of air are mixed with 1 volume of gas. But what benefit is this going to be to the ordinary consumer, seeing that about 5½ volumes of air to 1 volume of gas are required, varying according to the composition of the gas, to effect complete combustion? Regulation by the consumer of the air supply to his incandescent burners will still be necessary. Adding 2 volumes of air would also mean that by this amount the gas-conveying and storage capacity of the mains would be reduced at any given pressure—that is to say, at 10 inches pressure the volume of "neat" gas that the mains would be capable of conveying and storing would be reduced to the extent of the 2 volumes of air. We can see, under the suggested system, the distribution mains in a prosperous area requiring an early enlargement.

Another consideration is that all the gas appliances in a house do not require 10 inches pressure, to obtain high efficiency. This being so, it would become necessary, in order to get the utmost efficiency, for every appliance to be governed-down at each burner, cooker, or fire, to the particular needs, or to govern-down at the service-pipe to one pressure that would be most serviceable for all the applications of gas in each house. If there is governing-down at the service, then the capacity of the house piping, for the gas-and-air mixture, also comes into question. Air is everywhere; and therefore the more reasonable and economic proceeding is, if there is to be general governing on the consumers' premises, to save the distribution system for conveying and storing more of the greater necessary—gas—by using increased pressures. There is a point at which, on the consumers' premises, according to the appliances used, high pressure becomes an intolerable nuisance, unless there are the means for proper and accurate regulation.

However, Mr. Roberts is only waiting his opportunity for carrying out the plans in this respect, as sketched in the address; and the "opportunity" is when Parliament will allow him to adopt a calorific standard. Parliament will permit him to do this in the next session, if he is so minded; but Parliament will want to know something more

about this gas-and-air mixture. The standard of quality that Parliament allows—whether it be illuminating power or calorific value—is the quality of the gas that must be delivered into the mains, and not a quality *plus* a diluent over which the test as to quality has no control. Under Mr. Roberts's proposal, Parliament, not knowing the proportion of air to gas that an enterprising manager would deliver to his consumers, would want to fix a calorific standard of quality for the mixture, and not for the gas only; and would also desire to see the consumer was safely protected as to price for the measured mixture. So we are afraid Mr. Roberts would produce statutory complications, and other conditions regarding which we cannot detect the same amount of feasibility that he does. However, if he can obtain parliamentary sanction to put into practice his proposal, by all means let him do it. We much prefer experiences derived from practice to irrevocably basing our beliefs on theory or unproved considerations. We shall watch with peculiar interest for any development of the plan that Mr. Roberts has got planted in his mind. Just at the present, however, we doubt whether there will be any development. We must "wait and see." Perhaps when the new Parliament is sitting in Dublin, the legislators will not be so implacable as those who sit in judgment on Private Bills at Westminster.

The Doctors and Electric Lighting.

"Since electricity has been substituted for gas, the eyesight "of the students has been very much affected." These were the seriously spoken words of Dr. Brindley James (who has had twenty years' experience as the Medical Officer to a training-college) at one of the sittings of the International Congress of Medicine last week. It has been a common thing for our electrical friends to advise householders and others to ask their medical men this or that regarding lighting and heating by gas and electricity. The literature in which this advice has been given has not granted the reader time to have an independent consultation with the medical man; but it has gone on to state that "the medical man will "tell you that the use of gas in any way is bad." Being thus informed as to the likely result of the suggested consultation, the householder has not troubled to put the proposal into execution, but has fallen back upon his own individual experiences. There may be some mediocrities among the doctors who still cherish certain superstitions about gas, but they are a gradually declining number; and those who do survive would find a suitable place among those whom one member of the congress thought ought to return to school in order to bring their knowledge into conformity with the present times. But so far as the relative claims of gas and electricity are concerned, the number of medical men who cling to the aged errors are comparatively few. In regard to heating, the growing use of gas-fires by doctors—there are nearly 4000 of them who are users in the district of the Gaslight and Coke Company—must make the electrical people feel that those very householders whose custom they have been trying to gain by deception must regard them with anything but feelings of respect for their witless and groundless attack upon gas. As to lighting, such opinions as those uttered by Dr. Brindley James, and cited in the opening lines of this article, will do an immense good among not only medical practitioners but also the public, by their dissemination.

There were many such opinions expressed at the congress, by men of eminence among their colleagues; for, on two separate occasions last week, there were opportunities for talking about the effects of high intrinsic brilliancy and over-burdened ultra-violet ray lights. One occasion was when Dr. J. Herbert Parsons (Ophthalmic Surgeon and Lecturer at University College) introduced the subject of "photophthalmia," and the other was when Dr. James Kerr, the Medical Educational Officer under the London County Council, dealt with the subject of the "Causes, Prevention, "and Treatment of Visual Defects in School Children." "Photophthalmia," it was explained by Dr. Parsons, is a technical name that he has invented to express eye inflammation produced by exposure to artificial sources of light which are rich in ultra-violet rays—such as the naked arc electric lamp, the metallic filament lamp, and the mercury vapour lamp. Dr. Parsons finds that this eye trouble is more acute, and is being met with more frequently, than ever; and it is not surprising, seeing how local governing bodies in possession of electricity supply undertakings have been installing electric lamps in the most aggressive and extravagant manner, wherever they possibly could do so, without the slightest consideration for eyesight or scientific application, but for the sole purpose of increasing the output of their electric stations. A more egregious instance of incompetent government in the general interests has never been witnessed than since municipal authorities have themselves been governed in their actions by trading in electricity. Well might one person, who was concerned in the proceedings on this subject at last week's congress, say that the time might not be far distant when everyone would have to wear coloured spectacles at night where the artificial light was most striking and trying. Dr. Leslie Mackenzie said his eyes very much resented excessive light; the effect of the blinding lights now used being to stimulate the optic nerves. Dr. Lawson thought that more attention should be paid to the effects of the ultra-violet rays. Dr. Wainwright asserted that a great deal of eye trouble was due in modern days to the irritating effects of electric lights and unshaded lamps; while Mr. Bishop Harman called attention to the extremely bad way in which shops are illuminated, and suggested that this was a subject for legislation. In such statements as these, including the experience of Dr. Brindley James with which this article opens, we have the further evidence of medical men being actively moved by what is going on about us through the use of electric lamps of high intrinsic brilliancy and rich in ultra-violet rays.

Of course, we shall be told that there is no occasion for alarm on the part of the medical men of the country, because all that has to be done is to screen or shade the lights, and prevent them and the optic organs having any direct communication. But the trouble is that the concern of the salesman of electricity and of electric-lighting appliances is, in regard to the eyesight of his customers and the man in the street, or the child in the school, in inverse proportion to his eagerness to get custom at any price, even at the cost of other people's eyesight. The medical *savants* who were last week talking of this subject and of the proper utilization of light, and giving their experiences as to depreciating eyesight since the eye-piercing metallic filaments and the stronger arc lamps have been among us, were mainly referring to lighting in schools and other public places. But there is the home, where the eyes are used more than in any other place under artificial light. What is found in homes electrically lighted? With metallic filament lamps, the utmost abandonment of all that is scientific and protective; and the local electricity men dare not tell the truth of the matter, for very fear of doing damage to their eye-injuring business. The public notice of the views of the doctors at the congress should do good in drawing general attention to the matter; for equal to, and in some respects exceeding, other questions of hygiene is ocular hygiene. Deterioration of eyesight is a national loss and must be prevented.

Among the *obiter dicta* of the congress, was a remark that was made by Dr. L. A. Parry, of Hove, to the effect that it would be well if the members of Education Committees were compelled to pass some elementary scientific examination in hygiene. It would indeed be an excellent thing, especially if the elementary scientific examination included the subjects of ocular hygiene and photophthalmia; for educational committees have in many towns throughout the country simply been led by the noses by electricity supply committees into wasteful expense, and into the exposure of the eyesight of young children to the very lamps—the metallic filament electric lamps—that the doctors condemn on account of their high intrinsic brilliancy and richness in ultra-violet rays. The proceedings in this respect between educational committees and electric supply committees have too frequently been of a shameful character. Where lighting of the kind has been adopted, members of educational committees who have been misled and hoodwinked through insufficient personal knowledge ought to make it their individual business not to rest content until complete protection has been established between the eyes of the children and the injurious lamps. Let them remember Dr. Brindley James's words, after an experience of nearly twenty years as medical officer to a training college: "Since electricity has been substituted for gas, the sight of "the students has been very much affected." These words ought to be brought to the notice of every member of every educational authority in the country. This coming on top of Dr. Ives's testimony as to the spectrum composition of incandescent gas lighting being closer to sunlight than that of electric light [*ante*, p. 421] will not at all suit the books of our electrical competitors.

Calorific Expressions and Measurement.

It is no reflection upon Mr. Jacques Abady to say that, in the lecture that he delivered before the Irish Association last week, there was nothing that was particularly new to those who have followed the principles of, and developments in, the measurement of the calorific value of gas. But the time has now come for this matter of calorific measurement to be kept constantly to the fore in the gas industry, because calorific value is now raising itself among us as a standard of quality, and we do not want, as Mr. Charles Hunt was pointing out last week, a muddled form of expression or differences in the statement of values in standard calorific clauses. Mr. Abady's lectures are therefore instructive and useful, carrying as they do among many much less acquainted with the subject than himself (and yet who may have a voice in the adoption of a calorific standard for their own undertakings) information as to what is proper and right in these respects. In this lecture to the Irish Association, he starts from the elementary base as to expression, and works upwards. He explains the differences between the two thermometric scales to which one is accustomed in gas-testing work, and between calories and British thermal units, and then presents the factors by which conversions are readily made. It is quite true that it is perfectly easy for some people to make mental comparison by whichever expression the thermal value is rendered; and the more practice one has at calorimetric work, the easier this becomes. But in the gas industry we have grades of intelligence and arithmetical ability with which to deal, and all have not the cerebral agility to make rapid conversions without pencil and paper.

Partly for this reason, and partly to retain something of a symmetry in technical nomenclature in statutory calorific clauses, we have urged the adoption of all-British expressions, so as to get a common British rendering. Mr. Abady shows how easy it is to convert the readings of the calorimeter into British terms; and if there is one place where it is easier to do this than any other, it is in the room where the tests are made, and by the operator himself. Better one conversion by him, than have many people who want to compare British equivalents making more or less approximate conversions in their heads, in order to get to a common basis of comparison which they best understand. Unless one form of expression is favoured, we shall be having, side by side, contributions (say) to our technical organizations giving a beautiful variety of terms. This, however, as Mr. Abady says, is nothing more nor less than a matter of expression; but a matter in which a principle is involved is in the adoption of "gross" or "net" value. The lecturer reiterates his counsel to the gas industry not to give way on the "gross;" and he shows cause why. We think that the advice, which has also been given by several other experts, will not fall on deaf ears. Touching this matter, the lecturer is a strong believer in giving gas its full due of heat value; and therefore his explanation and advocacy of a "total-heat" calorimeter will be read with interest, though it is not the first time that reference has been made to it by Mr. Abady from the technical platform. Gas has always more or less suffered from outside causes contributing to a low representation of its standard quality; and in calorimetry as ordinarily practised one invariably gets lower readings than those to which the gas has a claim. Therefore, through appliances, methods, and renderings, Mr. Abady holds that gas is entitled to the fullest measure of heat value that it is capable of developing. There is likely to be a spurt in the adoption of calorific value standards in the next and immediately following parliamentary sessions. In view of this, a general resolution should be made to adopt a common form of "expression" throughout the clauses that will be inserted in Acts and Orders.

The Selas System of Lighting.

When a commercial representative of a competing system, whether lighting, heating, power, or what not, presents his views on the system on any occasion—when attempting to secure a customer, or when presenting the case for the system before a technical organization—it is only natural that he should do his best to make out an excellent case for it. If he could not do so, then, we may take it, his tenure of representation would be, in the interests of his employers, short-lived. That is the feeling with which one ends the reading of the paper that Mr. A. Docking, of Manchester, read, upon the "Selas System of Lighting and Heating," before the Irish Association last week. If the representative of a competing system read a similar paper, we venture to say that he would make out an equally good case for the one that it was his business to champion. Yet on the surface of what is said in the one paper, nor possibly of what would be said in the other, is there (nor would there be) much to criticize that is important as affecting the systems. This being so, we are not disposed to say much of the advantages nor of the disadvantages of any particular system of lighting as presented in the paper before us. But in our view, there is in the contribution a little more tone imparted to the advantages of the "Selas" system and to the so-called comparative "disadvantages" of other systems than would be the case if the paper had been prepared by an altogether disinterested gas illumination engineer. This does not mean that we have any partiality as against the "Selas" system. It has points about it that have commended it to engineers, and will do so again; and those who have been responsible for the development of the system deserve all the reward they can get from it commercially for the persistence with which they tackled early problems and difficulties, and for the expense to which they went, before they realized a success that made it dependable and marketable.

Briefly, the fundamental part of the system is the mixing (by a special apparatus) of gas and air in the proportions of approximately two of air to one of gas, and sending the mixture through piping to burners, where the balance of the air to effect complete combustion is obtained. The production of a mixture of definite and invariable composition at constant pressure, it is claimed, has an effect on the performance of the burners—we take it in the way of higher flame temperature—which enables them to give an efficiency exceeding that of other high-pressure gas systems, which position the owners of other systems would be prepared to deny. We cannot, for instance, at all see why, in a high-pressure lamp where the whole of the gas and air mixture is exposed to special heating, expansion, and so forth, the mixture should not arrive at the point of combustion of as definite and consistent a quality as the mixture that is composed first (say) of two volumes of air and one of gas at a mixing-machine, and then supplemented at the burner by the major part of the air required to produce complete combustion. We should need something more tangible than hypothesis to convince us that this was not so.

As already said, we are not going to discuss Mr. Docking's paper point by point. There are, however, one or two other matters upon which we should like to touch lightly for information purposes only. It is seen from one of the tables that the efficiency of the "Selas" lamps is "guaranteed;" and the guaranteed figures are quoted. Up to 300-candle units, an efficiency of 50 candles per cubic foot per hour is claimed; but it is not stated whether the author refers to cubic feet of mixture or of gas. It may, however, be taken that he means gas; and it may be submitted that, where a "guaranteed" efficiency is given, it would be just as well to mention the quality of gas necessary to ensure the performance. From a reference we shall make to Manchester, we are somewhat afraid Mr. Docking himself does not know this. At a 500-candle power unit, the efficiency ascends to 55½ candles; and from the 1000-candle power units upwards, the efficiency is round about 59 to 60 candles. In the "guaranteed" table, we see the 100 candle power unit is allowed a consumption of 2 cubic feet; but in the subsequent comparative table, where consumptions, heat, carbon dioxide, and other figures for different systems are brought into contrast, we see that a 100-candle power unit of the "Selas" light is credited with giving 100-candle power on 1·8 cubic feet of gas. Later on, it is found that 1·8 cubic feet was the consumption when using Manchester gas of a "reputed candle power of 14 candles." Now in the last annual report of the Manchester Corporation Gas Department, the average quality of the gas supply, during the year ending March last, was 16·88-candle power. In the table again, we see that the gas with which the comparison is made is supposed to have a calorific value of 550 B.Th.U.; but it is not stated whether this is the "gross" or the "net" figure. In quoting calorific value, this should be stated, as the difference is important. Now we undertake to say that Mr. Docking has not made tests with all the burners mentioned in his table, on the "reputed" 14-candle gas, which (we take it from what follows) should be given as 16·88-candle, or with gas of 550 B.Th.U., whether this figure be a "gross" or a "net" one; for we know that with

gas of a lower illuminating power than 16·88 candles, and of a lower gross calorific value than the one mentioned, 100-candle power has been, and can be, obtained, with a properly equipped high-pressure lamp, on a consumption of 1·75 cubic feet, and not the 2·4 cubic feet mentioned in the table for high-pressure gas.

We are sorry to make these criticisms; we are still more sorry to see Mr. Docking publishing a table giving the quantities of carbon dioxide discharged into a room per hour with the consumptions of gas cited. The competitors of the gas industry are ready enough to make all possible capital out of figures that are published, and particularly exaggerations such as are to be found in this table. It will be seen that Mr. Docking makes out that 7 cubic feet of carbon dioxide are discharged into the room for every cubic foot of gas consumed. We want to know how Mr. Docking got this 7 cubic feet of carbon dioxide per cubic foot of gas, seeing that 1 volume of gas yields on combustion approximately only 0·5 volume of carbon dioxide. We think Mr. Docking should at once cancel the table, and admit its incorrectness—unless, of course, he has some explanation to offer which, at the moment, surpasses our wit to discover.

The Leeds University and the Gas Industry.

In other columns this week, we publish the report of Professor John W. Cobb, Livesey Professor at the Leeds University, on the past year's work in the Department of Coal Gas and Fuel Industries. The report goes much farther than the work of the year; and we look very hopefully upon its practical nature, tone, and suggestiveness. In view of the importance of the report, we reserve, until our next issue, some editorial comments on what we regard as its main features.

Changes and Prosperity at Croydon.

The point of main prominence at the meeting of the Croydon Gas Company last Friday was the retirement of Mr. James W. Helps, who has been the Company's chief technical and managerial officer through the years that the concern has been winging its way with the greatest speed to higher and higher levels of prosperity. Eloquent tribute was made to his long and successful services. Proprietors, like Directors, regretted that the cause of ill-health should be the one for the severance of the official tie. But it had to be. On the other hand, all were pleased that the Directors had appointed those who had been proved by service in the Company to be the right men for the superior positions in a reorganization of official responsibility and duties. We wish Mr. Archibald Caddick every success as Engineer and Works Manager, and Mr. W. J. Sandeman as Distributing Engineer and Sales Manager. Another appointment has been made which has given much satisfaction to the proprietors, and that is Mr. Reginald A. Helps has been selected as assistant to Mr. Caddick—not, emphatically declared Mr. Charles Hussey, the Chairman of the Company, last Friday, because he is the eldest son of Mr. J. W. Helps, but because of his personal abilities, training, and testimonials. While the proprietors are gratified over this continuation of the name of Helps in official position, the appointment has naturally given great pleasure to the father of the new officer. The higher responsibilities are taken over by Mr. Caddick and Mr. Sandeman, with everything flourishing. Concrete evidence of never-ceasing expansion are seen. The Engineer is at once faced with the construction of a large new gasholder; and the curve of connections under the care of the chief of the distribution department rises to higher and higher heights in every direction. The organization of the distribution and sales department was never in a more thoroughly sound position than it is to-day.

The Leeds "Gassing" Fatality.

It must be a source of much satisfaction to the firm of gasholder constructors concerned with the deplorable "gassing" fatality which occurred at the New Wortley Gas-Works of the Leeds Corporation on Tuesday last, as reported elsewhere, to find that the result of the investigation by the Coroner resulted in the Jury returning a verdict of "Accidental death," without the addition of a "rider," indicating that at the back of their minds there was an idea that the arrangements for carrying out the repairs to the holder were not what they should have been. These, however, were in the hands of an experienced foreman accustomed to the work; and he appears to have taken every precaution that the atmosphere in the interior of the holder should be such as to allow the men to enter. For an entire fortnight, about 72,000 cubic feet of air per hour had been blown through the holder for nine hours a day; and evidence was given to the effect that the aperture at the top of the crown was sufficient to ventilate it effectively. Surely this justified the foreman in expressing the opinion that, to use his homely language, the holder was "as sweet as a nut." Unfortunately, the loss of his own life and that of another workman proved the contrary. The Factory Inspector who attended the inquest thought the men should have been provided with helmets. But the firm's Outdoor Superintendent said they could not be used with the class of work in question. He admitted, however, that there would have been less likelihood of foul gas being present if the water in the tank had been drawn off and fresh water put in; though this had not, he said, been done when the holder was repaired on a previous occasion. Considering the length of time the water had apparently been in the tank, the temperature on the day of the occurrence, and the barometrical conditions, it may not be difficult to account for the presence of the foul gas. Its effect, however, was lamentable. On behalf of Messrs. Clayton and the Leeds Corporation, sympathy was expressed for the relatives of the two victims of the accident; and we are sure it will be shared by many who read the account of it.

A Consoling Reflection.

There is one consoling reflection in connection with this unfortunate occurrence, and it is that it furnished evidence of the continued existence of that courageousness in face of danger which is a characteristic of the British race, and which has led men unhesitatingly to attempt rescue work, and, as in the present case, to succeed only with disastrous consequences to themselves and those belonging to them. At the inquest under notice, the Coroner made special reference to the fact that "all concerned seemed to have been reckless of their own lives in their attempts to succour and relieve the others;" and the Jury expressed their concurrence with these remarks. The Factory Inspector referred to the actions of three of the men as "particularly brave;" and he said he should consider it his duty to represent to the proper authorities that these men should receive special recognition. Whether or not they get any tangible reward for their conduct, they will have the consciousness that they manfully did their duty in specially trying circumstances; and their names will be added to those of many of their fellows who have shown, as testified by the reports of the Factory Inspectors and in the Press, that heroism is not restricted to the field of battle, but is equally conspicuous at times in the world of industry.

Increased Cost of Living.

Among the social and economic questions of the times is the one of the increased cost of living and the relation of wages to the additional claim upon the family purse. Last week the Press of the country noticed the report giving the results of the limited but representative inquiry made by the Board of Trade into the question of the movements of rents, retail prices of necessaries, and wages. The survey included 88 of the principal cities and towns of the country; and it embraces wages in the building, engineering, and printing trades. We have no intention of reproducing the figures here, excepting two or three averages for the purpose of drawing a few deductions from them. We have generally known—individually we have been made aware of it—that the cost of living has increased; and those who think about the matter from the side of the workers (as most employers have done in the gas industry) have realized that this condition of things must press heavily on those who have really no margin of income Those, however, have been the indefinitely-shaped conclusions to which the statistics now published give form. The broad outcome of the statistics is to show that food and fuel costs have risen by about 13 per cent.; but inasmuch as in a number of the towns—in London and certain other places—rents of property occupied by the working-class have been diminishing, the net rise is about 10·3 per cent. But the law of averages ought not to be universally applied in this matter, because individual towns tell different tales. For instance, in London the cost of living has increased,

on the average, by about 12 per cent.; but rents, on the average, have declined by about 4 per cent. Taking averages again, wages do not show a corresponding increase with the cost of living.

Industry and Wages.

But industry and employers are not to be wholly blamed for this difference between the rise in the cost of existence and the rise in wages. In the gas industry, generally speaking, employers did not wait for official reports or upheavals of labour before recognizing the fairness and propriety of doing something (in the aggregate substantial) towards wiping out the difference; and there has been little trouble to chronicle among the workers of the industry whose interests are well tended. But while the country's skilled and unskilled workers have felt the weight of the increased cost of existence, so has industry; and in some considerable degree this has been brought about by labour itself, the results of whose sectional disturbances have curtailed the opportunity for workers generally sharing in the prosperity which has been ruling in trade throughout the country. When there is a turn in the tide of prosperity, the home industry will feel its burdens more in carrying on competition in the markets of the world. There is another matter that must not be overlooked; and it is that the increased volume of trade has produced increased employment, which means an enlargement of the area of the spending power of labour, and so an enhancement of the economic position of the country.

Light and Fuel Costs.

While retail costs, taking into account the average reduction of rents, have increased by the average net percentage of 10·3 in the towns in which the inquiries have proceeded, it is seen that, since 1905, household coal alone has gone up by about 22·5 per cent. The workers of the country cannot lay it to the charge of the gas industry that during this period there has been generally any increase in the cost to them of gas light and gas fuel for cooking. The industry has stood by the country's workers in this matter; and if the average cost of gas for light and heat were worked out, it would be found to be lower to-day than it was in 1905—this, notwithstanding the heavier cost of gas-producing materials, higher wages in the industry, increased rates and taxes, and other additional outlay caused by the course of legislative events, together with the increased claims of modern gas trading. If the cost of gas had risen as in the case of household coal by 22·5 per cent., the workers of the country who purchase light and heat for cooking through the ubiquitous prepayment gas-meter would have seriously and keenly felt the position. But the large business that is now done by the gas industry among the country's workers, makes the administrators more solicitous than ever to strain every nerve to prevent the necessity of making an increase in the price—a point that the Chairman of the South Metropolitan Company (Mr. Charles Carpenter, D.Sc.) well made at the meeting of the proprietors last Wednesday.

Life of Steel and Cast-Iron Water-Mains.—In a paragraph in the current number of "Engineering," attention is called to the condition of the steel water-mains at Port Elizabeth, in regard to which Mr. William Arnott, the Manager of the South African Lighting Association, Limited, sent two letters which appeared in the last volume of the "JOURNAL" (pp. 602, 1019). Practically the whole of the mains, covering a distance of more than 25 miles, will have to be replaced. "Engineering" says it is interesting, in this connection, to note the life of water-mains made of cast-iron pipes. The life of those at Versailles is given as 249 years; at Weilburg, 210 years; at Clermont-Ferrand, 165 years; and at Glasgow, more than 100 years.

Mr. H. P. Maybury's Resignation.—At the last meeting of the Kent County Council, when this matter [see *ante*, p. 424] was reported by the Bridges and Roads Committee, Alderman Waring, the Chairman, said he was sure the Council would regret that this had occurred. The departure of Mr. Maybury would be a great loss to the county, and particularly to himself, as he had worked with him for years, and had nothing to say against him, with the exception of one thing—that he would not take a holiday. Mr. Maybury had been offered, unsolicited, the post of Chief Engineer to the Road Board, which was the blue riband of the profession. While regretting his departure, they wished him every success and long life in his new appointment. Alderman Cornwallis (the Chairman of the Council) said he was sure they would re-echo everything that Alderman Waring had said.

OBITUARY.

GEORGE ANDERSON.

THE death of Mr. George Anderson last Tuesday, at the advanced age of ninety-one, has removed probably the only remaining member of the gas profession who figured prominently in the stirring events of the middle of the last century in connection with the gas supply of the Metropolis. He carried on business in Westminster, towards the last in association with one of his sons; but he retired some few years ago, and since then he had lived quietly at his home in Upper Norwood, where he passed peacefully away.

George Anderson was born in Glasgow on April 16, 1822; his parents being citizens of Arbroath, in which town he spent the first years of his life. He had, on his own confession, but little schooling, and had not the advantage of much technical training as we understand it; yet he became, through force of character, one of the first gas engineers of his time. Moreover, he coupled with engineering ability remarkable capacity for business; and he exercised both with striking success. He first became connected with the gas profession through an introduction to Mr. Alexander Angus Croll, who was then (towards the close of the forties) constructing the gas-works at Tottenham; and Mr. Anderson was entrusted with the management of these works. Mr. Croll was also building gas-works at Leyden; and Mr. Anderson was frequently sent over to inspect them. From that time onwards, he was closely associated with the man who revolutionized the gas supply of London. He took an active part with him in the establishment of the Great Central Gas Company, in the construction of whose works at Bow Common Mr. Croll introduced several innovations—two being the abolition of the roof trussing of the gasholders, and the substitution of light lattice-work for the heavy cast-iron columns which had been used for the guide-framing. Gas was supplied from these works on Sept. 29, 1850. Mr. Anderson was the first Manager; and when he relinquished the position the works were placed in charge of Mr. Methven.

The success attending the formation of the Great Central Company led to the starting of the Surrey Consumers' Gas Company. The early times of this undertaking were troublous ones, with the result that the man who had shown such ability at Bow Common—Mr. Croll—was consulted. It was recognized that drastic change must be made in the manufacturing department, and the resident engineer was asked to resign. As he declined to do so, it was decided to "storm" the works. This was successfully accomplished under the direction of Mr. Anderson, who took possession, and conducted the concern till towards the close of 1854. Early in November of that year he was despatched by Mr. Croll to Constantinople, in order to report on a projected gas-supply scheme for the city. Nothing, however, came of it; and shortly afterwards the connection of Mr. Anderson with Mr. Croll was severed.

Mr. Anderson then commenced business on his own account. He first took a lease of the Dover Gas-Works, and was connected with the Company for twenty-one years. In this venture, as well as in that of Waterford, he was associated with Mr. Robert Hesketh Jones. Subsequently he became responsible for the gas supply of Cork, Fermoy, and other places in Ireland; and in conjunction with Mr. Stephenson Clarke, he purchased the gas-works at Bastia, in Corsica. The business in Westminster is now carried on by two of Mr. Anderson's sons—Mr. George W. and Mr. R. Bruce Anderson; while another—Mr. G. J. Anderson—manages the gas-works at Bastia.

Mr. Anderson joined the British Association of Gas Managers in 1866, passed into the Gas Institute, and kept his name upon the roll till the amalgamation with the present Institution. During his connection with the earlier organization he contributed the following papers to the "Transactions:"

1867.—"On the Extraction of Ammonia from Gas, and the Utilization of the Product."
1868.—"The Construction of Gasholders."
1869.—"Charging and Drawing Retorts by Machinery."
1871.—"The Benefits Arising from the Use of Exhausters."
"Further Experience of Tar Pavement."
1872.—"The Cheapest and Best Means of Abstracting Ammonia."
1874.—"Purification of Gas."
1875.—"Building and Heating Retorts."
1887.—"A New Process for the Distillation and Concentration of Chemical Liquids."
1889.—"Gas Purifiers."
1894.—"A Plea for Differential Charges for Gas."

The funeral took place at Nunhead Cemetery last Friday.

We regret to learn, from the "Zeitschrift des Vereines der Gas- und Wasserfachmänner in Östereich-Ungarn," of the death, on the 10th inst., of Dr. FRANZ HELTAI, the General Manager of the Municipal Gas-Works of Buda-Pesth. Dr. Heltai was President of the Austro-Hungarian Association of Gas and Water Engineers in 1911-12, and was Chief Burgomaster of the city of Buda-Pesth, and a member of the Hungarian Upper House.

PERSONAL.

Mr. DAVID WHILLANS, who is about to take up an appointment with the Hawick Gas Company, comes from Inverkeithing, where he has been employed in the office of Messrs. Easton Gibb and Son, the Contractors for the Rosyth Naval Base. He was presented with a handsome dressing case by the staff, the presentation being made Mr. Robinson.

There were 63 applicants for the position of Manager for a 15 million cubic feet gas-works in Australia, advertised in the "JOURNAL" for June 10 last, under No. 5745; and from them Mr. THOMAS MOSS, the Surveyor to the Withnell Urban District Council, and Engineer and Manager of their gas and water works, has been selected. He will sail from England on the 11th prox. The works of which he will have charge are situated at Oakleigh, a suburb of Melbourne, from which it is distant about nine miles.

In our advertisement columns the last week or two, a notification has appeared that the Shanghai Gas Company had a vacancy for a District Inspector; and we learn from Mr. J. W. Mackay, the Assistant-Engineer of the Company (who is at present in England), that the number of applications was very large. After interviewing several of the candidates, Mr. Mackay has given the appointment to Mr. W. E. NICHOLSON, who for the past fifteen years has been in the service ot the Gaslight and Coke Company, and is at present Assistant-Inspector of the Company's Kensington district.

At the meeting of the Croydon Gas Company last Friday, Mr. REGINALD ARTHUR HELPS, son of Mr. James W. Helps, was appointed Chief Assistant to the Engineer and Works Manager (Mr. Archibald Caddick). Mr. Helps is twenty-eight years of age, and received his general education at King's College, including technical training in the Engineering Faculty of the College and in the Erith works of Messrs. Vickers, Sons, and Maxim, Limited. He was an Assistant to Mr. H. W. Woodall, at Bournemouth, for five years, two of which were spent in the drawing office. At Bournemouth he acquired a thorough knowledge of the practical operations of a gas company in all its branches. Rather more than three years ago, he obtained the appointment of Assistant to Mr. Harry Morris, the Engineer and Manager of the Jersey Gas Company, under whose supervision he has been entirely responsible for the control of the works. He is a good chemist, and is thoroughly acquainted with gas-testing, photometry, tar and oil distillation, &c. In the distribution department, he has had, both at Bournemouth and Jersey, considerable experience in main-laying; and at the latter place he entirely rearranged the public lighting. He is an associate member of the Institution of Civil Engineers as well as of the Institution of Gas Engineers.

ELECTRICITY SUPPLY MEMORANDA.

THE "Electrical Times" has excelled itself in interfering with a subject about which it knows little, and is making itself a perfect laughing-stock among those who do know something about it. The subject is that of gaseous heating; and the latest vapourings of our contemporary in regard to it appear under the heading of "The Failure of Low-Pressure Gas."

"Failure" of Low-Pressure Gas.

Although high-pressure gas is an extending business, it represents but a drop in the ocean of business done in low-pressure gas; and therefore the so-called "failure" of low-pressure gas has an excellent showing in an impressive financial success. The gas industry is satisfied; the electrical industry is not. Therefore, the malignant distortion of facts such as are found in the opening and succeeding paragraphs of the article under notice. In the very first lines of the article, it is stated that, during the past year or two, evidences of the extreme disadvantages of low-pressure gas have been accruing at a pace that has ever accelerated. We have not so far seen the alleged evidences. What we have seen is that to realize a higher efficiency per cubic foot of gas consumed for certain lighting purposes, high-pressure gas is useful; and that for the higher temperatures in industrial work —say, above 1200° C.—it is also valuable, or, as an alternative, low-pressure gas with air-blast. But where high illuminating power from one source is unnecessary, low-pressure gas is all that is required; and where, in industrial work (or if "Meteor" of the "Electrical Times" simply wants to burn his fingers), a temperature below 1200° C. is sufficient, low-pressure gas is all that is needed. This, in all conscience, shows that the range of usefulness of low-pressure gas is not one to be sneezed at, or treated with contempt. It is, however, thought by the writer in our contemporary that high pressure is a first essential of economy. This depends on the purpose and object in view. But if high-pressure be essential, what, chirrups this superficially informed individual, "is the outlook for the present vast network of low-pressure mains already leaking so badly that explosions are of daily and almost hourly occurrence." Is it so very difficult for an electrician to open his mouth, or put his pen to paper, concerning gas without violating truth?

Queer Notions as to Heating.

The article in our contemporary makes reference to the paper on "Gaseous Heating" read by Mr. E. W. Smith and Mr. C. M. Walter, at the last meeting of the Institution of Gas Engineers. The whole argument, if one can call it so, in the article is an absurdity due either to gross ignorance of the subject dealt with, or to a deliberate distortion of the facts—perhaps a little of both accounts for the character of the argument. We have, as an opening to the extraordinary treatment on the part of our contemporary, the following paragraph: "We have heard a great deal recently of the alleged efficiency of gas-stoves. Such stoves are an inversion of what is attempted in a modern steam-boiler; the useful heat units become the losses, the leakage becomes the only useful heat. Nevertheless, we are actually told that the efficiency is that of a good water-tube boiler—75 per cent. We have demonstrated that it must be less than 20 per cent." We have not seen the "demonstration;" all we have observed has been a crowd of inconclusive words jostling all meaning and reason out of each other. But about the quoted sentence, who on earth can understand what the writer can possibly mean by gas-stoves [the writer is referring, we believe, to ordinary gas-fires] being an inversion of what is attempted in a modern steam-boiler? Nothing whatever was mentioned respecting gas-fire efficiency in the excellent paper by Messrs. Smith and Walter. The writer goes on to say that he gathers from the results obtained by the authors that gas heating is inefficient for eight reasons. This is really funny—about as funny as anything of which the "Electrical Times" has been both author and circulating medium. The arguments used to show that "gas heating is inefficient" are those which Mr. Smith raised to indicate that flame temperatures, *as obtained by calculation*, are inaccurate *as compared with the actual temperatures*, because the conditions that our contemporary quotes are not included in the calculations. Not one of these conditions necessarily interferes with gaseous heating efficiencies when correct means of conserving the heat—by proper construction, &c.—are adopted in each case, just as in electric heating furnaces. The writer, in his denunciation of low-pressure gas, entirely overlooks and disregards the fact that it is stated in Messrs. Smith and Walter's paper that low-pressure gas in conjunction with air blast will give equally as efficient results as high-pressure gas. He also overlooks the fact that the paragraph in the paper relating to white-metal melting with high-pressure and low-pressure gas is given as an instance where high-temperature flame heating is more efficient than low-temperature flame heating, and uses it as an argument that this also applies to all heating efficiencies. Would he apply the same line of argument to the difference between the electric arc furnace for smelting and the usual resistance furnace? We think not. The same applies to the mare's-nest he has found regarding the cost of compressing gas, which amounts to about 3¼ per cent. of the cost of the gas. But just as some electrical undertakings make no extra charge for any special apparatus lent, whereas others do so, gas companies in some cases loan compressors free, and in other instances make no extra charge for high-pressure gas obtained from their mains. Possibly the "Electrical Times" staff have never heard of the development of high-pressure gas-distributing systems in conjunction with low-pressure gas systems; giving the consumer the choice of any pressure that best suits his needs—Birmingham, whence Messrs. Smith and Walter hail, being an excellent example. We hope that ere long, for their own sakes, the members of the staff of the paper referred to will extend their knowledge of gaseous heating, in order to keep their pens and tongues from slipping in the ridiculous manner illustrated by the article before us.

More Looseness.

In the same article are some "Notes" for the illuminating engineer; and it is to be hoped that nobody claiming the right to be called an illuminating engineer will be such a fool, for his own reputation's sake, as to adopt the suggestion that he should make use of the information as presented, because if he does so, he will come a cropper. The idea of the writer is that Mr. D. R. Wilson's recent report on the lighting of foundries [*ante*, pp. 14, 47] is indirectly a complete condemnation of low-pressure gas lighting. There is not the slightest justification for drawing any such deduction from the report; and what is done is all of a piece with the rest of the misleading performance before us. In Mr. Wilson's tables, there are several cases where the amount of illumination by flame arcs and metallic filament lamps is described as "excellent;" but not in one case is gas lighting given such a description. We have "good" placed against high-pressure inverted lamps; "fair" against a foundry containing three-burner inverted lamps; and "very good" against another example of three-burner inverteds. But throughout the list where flat-flame gas-jets are employed—as would be expected—is placed the word "poor." No gas man worthy the name would think of recommending flat-flame lighting in these days of inverted gas-burners. But regarding the more modern forms of lighting, there are certain factors omitted by the writer of the misleading "Notes for Illuminating Engineers" in our contemporary. One is as to the relative illuminating power of the sources of the lights (which he could have given for all but the ancient gas-jets); another is the height and spacing; and a further one is the relative cost (which he could not have given, seeing that Mr. Wilson does not publish the information). When comparison is made of the high candle-power flame arcs with the

low candle-power incandescent gas-lamps employed, one can at once see that it is by the force of the quantity of light, and nothing else, that the descriptive term "excellent" is earned by the flame arcs. In the case of the high-pressure gas-lamps to which allusion is made, they are only of 200-candle power, compared with 1000 to nearly 4000 candle power in the case of the flame arcs. The "very good" three-burner ordinary inverted gas-lamps are given as of 1500-candle power each. But they are fixed 34 feet apart, and at a height of 26 feet from the floor; whereas the arc lamps are mostly hung nearer to the floor. If the factories that are electrically lighted (unless, of course, they have special facilities in regard to the generation of electrical energy by their own gas-driven plant) were illuminated by gas in an up-to-date fashion, we venture the opinion, with a large amount of assurance, that, for the same or less expense, considerably more light, and light of much better quality and colour, could be obtained. Gas mantles are stated in the article to be an insufferable nuisance in factories. Is this the reason why several factories in the country have changed from electricity to modern gas lighting? If mantles are not an insufferable nuisance, how, the writer in our contemporary would like to know, is it there are so many factories still lighted by flat-flame gas-burners? The factory inspectors explain—because of sheer apathy on the part of the factory owners. There is not the slightest proof in the report that low-pressure gas for industrial lighting is a failure. If the "Electrical Times" will contrast comparables and not incomparables in respect of units, height and space, and cost, it will find that someone on its staff is a "failure" either in appreciation, or in the honest presentment, of facts. Meantime, in connection with factory lighting Dr. Ives and Mr. Thorne Baker have found [see leader columns last week] that the spectrum composition of incandescent gas lighting approaches nearer daylight than ordinary electric lamps; and just as the doctors are cautioning the public, so the factory inspectors are busy warning factory owners to protect the eyes of the operatives against glare—especially of electric metallic filaments.

Ultimate Object of a Point-Five.

It was mentioned in the "JOURNAL" last week that Mr. Horace Bowden, of Poplar, had replied to the interrogations submitted to him by Mr. A. Nichols Moore to test the soundness of the position adopted by the members of the Point-Five Association. But we are of opinion that Mr. Moore will not be satisfied with some of the replies—clever, but not all convincing—that Mr. Bowden has now put forward. His answers should, and no doubt will, give rise to a fair amount of controversy, private if not public, among electrical engineers. There were, as we stated last week, twenty-six questions; but Mr. Bowden does not want it to be considered that his "catechetical statement" is in any way representative of the views of all the members of the "Point-Five" Association, but only of his own personal convictions. We are only interested in a few of the replies; interest in the others will probably grow with their discussion. Watching the game from the outside, there may be something more worth talking about when the opposing parties have both come to the end of their tether. Mr. Bowden is not one, we understand, who makes a flat-charge of 0·5d. per unit for any domestic purpose; but he proposes a certain fixed charge *plus* 0·5d. per unit. Therefore, on his own showing, he ought not to be eligible for the "Point-Five" Association. What is a Point-Five? asks Mr. Moore; and Mr. Bowden replies "a chief engineer of any undertaking making a distinctive charge of 0·5d. per unit for the supply of energy for domestic purposes." The man who makes a charge of 0·5d. per unit *plus* the proportion of a fixed annual charge, cannot be said to be making a "distinctive charge of 0·5d. per unit." What is the ultimate object of a Point-Five? inquires Mr. Moore. Mr. Bowden's answer shows that the Point-Fives have no unanimously settled ultimate object. Their ultimate objects appear to be simply matters of personal opinion; so that there must be a splendid diversity of tenets in existence among the members of this select body. Mr. Bowden, however, has an ultimate object. It is to "abolish a charge per unit of energy, and to supply a given service for a given sum per annum." The sale of current at 0·5d. is, with him, "merely a temporary arrangement during a transition period." The Borough Council of Poplar had better keep a sharp eye on the "ultimate object" of their technical electrical adviser. It is leading them back to the place where the gas industry started, and which resulted in such disastrous record and ruinous business that the gas industry had to reconstruct its position, and to produce equity as between consumer and consumer—careful consumer and more or less extravagant consumer—by adopting the ordinary modes of trading, measuring the commodity, and charging accordingly. In order to prevent loss without measurement, a rate must be fixed that will cover extravagant use; and in fixing the rate those who are careful and frugal must suffer by the extravagance of others. That is where discontent comes in even in connection with water supply. But in this case it is recognized that the free use of water for domestic purposes is a sanitary benefit to the whole community. Even the great Metropolitan Water Board, with some of the best brains in its composition from the Metropolitan local authorities, and with all their resources, have not yet been able to make both ends meet; and they work on the system which is Mr. Bowden's "ultimate object." Another point is that there is not enough elasticity in the principle in view to allow for varying costs. We repeat that the Poplar Council had better keep a strict eye on Mr. Bowden's "ultimate object," though we think that gentleman does not consider his objective is likely to be reached in the immediate future. But it is difficult to know just what some of our electrical friends think, judging from the peculiar things that appear from their pens. General business on a fixed charge without meter and a charge per unit would be the height of folly. That is a "personal conviction" based on the lessons of the past.

Working Costs and Fixed Charges.

Mr. Bowden proceeds to say that, before commencing the 0·5d. per unit campaign, he gave consideration to every conceivable phase of the problem; but he does not take his readers into confidence as to what these phases are, nor as to their details. In the succeeding reply, he evades what we conceive to be the intention of Mr. Moore in asking: "Do you and *all* members of the 'Point-Fives' maintain that you can sell electrical energy at 0·5d. per unit, and make a profit by the sale of those units, after allowing for all legitimate and necessary charges. The answer vouchsafed to this is somewhat cryptic. It is that "the sale of current only at 0·5d. per unit carries with it an average profit of 0·2d. per unit. All other legitimate costs which I assume to be fixed costs, and which will, in my opinion, be the basis of the ultimate charge, are allowed for in the fixed annual charge." The "Electrical Times" gives 0·71d. as the "working costs" at Poplar for the year ending March, 1912. A little light, but an uncertain and unsatisfactory amount, is thrown on Mr. Bowden's meaning by a succeeding answer, in which he states that all legitimate and necessary charges are divided under two headings—viz., running and fixed. "The former are those which entirely depend upon the output of energy, and the latter those which are incurred irrespective of output. The distinction is readily made by *allocating to the latter*, at the commencement of each financial year, *all known charges* which will be incurred during the ensuing year." Mr. Bowden appears here to be advocating something that is not customary in the matter of discriminating between working and fixed costs. If revision of the fixed costs is to be at the commencement of each year by including in them "all known charges," it follows that the fixed annual charge to the consumer should also be revised.

Principles and Practices.

It will not be surprising if Mr. Bowden does not call down upon himself the reproach of those engineers who in certain cases are charging a flat rate of ½d. per unit for heating and cooking, without any consideration for the fixed charges. Mr. Moore asked: "If the 'Point-Fives' attain their object, do you admit that in such towns as Reading, Barnes, Luton, Southampton, and St. Marylebone, the residential load will form the greater portion of the load of the station?" Mr. Bowden declines to answer. He thinks "it advisable to wait and see if the engineers of the places named care to reply on their own behalf." The wording suggests doubt on his part. Among other questions, were two referring to the hiring by consumers and purchase by the undertaking of heating and cooking apparatus. Mr. Bowden acknowledges that he does hire-out such apparatus, and wire premises to connecting points of all apparatus; and he admits that all appliances of this description are purchased out of revenue. The information is insufficient to enable anyone to judge whether the payment by the consumer in the form of rent covers all the expenses incurred; if not, the lighting consumers who contribute the profits have an additional burden placed on their backs. Some of the other replies are distinctly up against those who charge a flat-rate of 0·5d. for cooking. For instance, Mr. Bowden says that he is not prepared to state that for traction supply 1d. per unit is not a fair charge. His opinion is that a profitable charge should be a fixed sum per annum, *plus* 0·5d. per unit. Nor does he consider that working costs alone should constitute the basis for fixing a charge for the supply of energy. Whether a flat-charge of 0·5d. per unit is fair, he leaves to the defence of the seven 'Point-Fives' who are indulging in it. He also considers that 5 per cent. *gross profit* is out of the question; and that 66⅔ per cent. is nearer the mark. Perhaps Mr. Moore will find it easy to show that certain electricity undertakings fall very far short of the 66⅔ per cent. gross profit on some of their dealings. We see that Newport, according to the "Electrical Times," finished the year ending March, 1912, with a deficit of £1998. Mr. Bowden does not think that any distinction should be made in the running charge for the supply of energy. This charge in all equity should be the same, no matter the purpose to which the use is applied. In all seriousness, we suggest that Mr. Bowden should consider this reply in relation to his own dealings. Close to this last-mentioned reply, Mr. Bowden says that he does not consider a municipally owned undertaking should adjust prices to suit the amount of competition encountered under any circumstances. He thinks that prices should be governed by the reduction in the cost of production, and that every class of consumer should participate in the benefits derived from the progress of an undertaking. It is interesting to study a man's views on abstract principles, and then compare them with the concrete issues of his practices.

Upwards of 27 feet in height, and holding a ton of carbide, which will light it for a year, an automatic acetylene gas-buoy has been placed in the Wash. It has a light of 120-candle power, which is visible for ten miles.

ANNUAL REPORT OF THE LIVESEY PROFESSOR.

We have received from Mr. J. W. Cobb, B.Sc., F.I.C., the Livesey Professor in the Department of Coal Gas and Fuel Industries (with Metallurgy) in the University of Leeds, a copy of the report he has lately made to the Livesey Advisory Committee, and we give it below. It furnishes a general account of the work of the department; the points of special interest being the new diploma courses, particularly the "half-time" courses, the opening of the laboratory for selected students on one evening a week, and the research work.

Gentlemen,—In presenting this report on the work of the past year in the Department of Coal Gas and Fuel Industries, I do not wish to make it too purely formal, but to submit the results as plainly as possible for your consideration.

Students.—The number of registered students specially attached to the department at present is ten, as against seven for the previous year. There are three students working for degrees in "Gas Engineering," two for degrees in "Fuel and Metallurgy," three first-year degree students who will make the choice between "Gas Engineering" and "Metallurgy" at the beginning of next session. In addition, there are two non-degree day students, one a candidate for the associateship of the Institute of Chemistry. There are no diploma students; but it is hoped that a revision of the diploma regulations which has just been made [detailed below] will increase their number in future years. Besides the courses to students mentioned above, lectures on "Fuel and Metallurgy" have been given to all the first-year engineering students of the University.

Special Lectures.—The special lectures given on Wednesday evenings, Thursday mornings, and Saturday afternoons have been well attended, and seemed to be much appreciated. Although giving this class of instruction cannot be regarded as the primary function of the University, in connection with the training of gas engineers, it seems to meet with more immediate success so far as can be gauged by the number of entries obtained.

The course of twenty lectures on the "Distribution and Uses of Coal Gas" was attended by 21 students, and included:

Eight lectures on "Distribution of Coal Gas," by Mr. Walter Hole, of Leeds.

Four lectures on "Gas-Stoves, Gas Heating, and High-Pressure Gas," by Mr. E. W. Smith, M.Sc., of Birmingham.

Four lectures on "Gas Lighting and Photometry," by Mr. Jacques Abady, of London,

and also four lectures by Professor Smithells and myself on "Flame and Gaseous Combustion."

A course of eight lectures on "Bye-Product Coking Processes" was given by Dr. M. G. Christie and Mr. W. Greaves, the Manager and Assistant-Manager respectively of the Otto Coke-Oven Company, and was attended by 41 students.

The attendance at these special lectures was, therefore, satisfactory; and good work was, I believe, accomplished. But the lecturers would undoubtedly be in a better position to do justice to their subjects if the educational level of the students on entry could be raised.

These lectures were followed by brief discussions, which were sometimes very interesting and instructive from the number of questions asked, arising out of experiences in works practice.

Staff.—The laboratory work during the year has been under the immediate supervision of my Assistant Lecturer and Demonstrator, Mr. H. J. Hodsman, M.Sc., who has been appointed since the last meeting of the Committee. Mr. Hodsman, after graduating with honours at Leeds, became a successful student with Professors Haber and Bunte in Carlsruhe and Le Chatelier in Paris. He has also had works experience; and his services have been of great value to me. We came together into a department left without professor or demonstrator; and although that position was not without some obvious advantages, it entailed some considerable difficulties. I may say that the University has already recognized in a practical manner Mr. Hodsman's work and usefulness.

Equipment.—The equipment of the laboratory has been inincreased during the year by the purchase of a Worthington gas-compressor (to facilitate experiments and demonstrations on high-pressure gas or high-pressure blast), commercial gas analysis apparatus and calorimeter, platinum and silica ware, and a new larger electrical tube furnace.

At my request, the University has made a grant for apparatus to be used in work on refractory materials; and the first purchase from this grant has been an electrical furnace designed for very high temperature work. The Worthington compressor will be of assistance in this direction also. The testing of fire-bricks with some form of gas-furnace seems very desirable.

The study of refractory materials is of great and increasing importance to gas engineers and metallurgists, and must, I think, be regarded as essential for us to undertake seriously. Works facilities kindly made available and my own experience in this class of work should be of service to us in undertaking it.

Museum.—Additions have been made to the specimens in the departmental museum by:—

Farnley Iron Company .	Refractory materials (fire-clay, bauxite, silica, magnesia, &c.) in the raw and manufactured state, bricks before and after use in furnaces. Best Yorkshire iron in its stages of manufacture, slags, &c.
Sir Robert Hadfield . .	Special steels and alloys and steel armour-piercing shell.
Through Mr. Hodsman .	Copper ores, mattes, &c.
Otto Coke-Oven Company	Coke and bye-products.

Research.—The Senate of the University elected Mr. H. Hollings to the Gas Research Fellowship in October, 1912; and the Council of the Institution of Gas Engineers approved the election. At my suggestion and under my supervision Mr. Hollings has been engaged on two lines of work:—

(1) Thermal stages in the carbonization of coal; an attempt to divide by physical measurement the carbonizing process into stages, some of which my evolve and some absorb heat, the results to be correlated with those obtained by chemical means.

(2) A study of the influence of red-hot coke, and of heat radiated from hot surfaces on the products of carbonization of coal. This study is made on the gases evolved from coal itself, and also on prepared mixtures of the gases and vapours known to occur in ordinary coal gas, coke-oven gas, water gas, and producer gas.

The work is going on satisfactorily, and will, I hope, give positive information useful in practice.

Along with Mr. Hodsman, I am working out an apparatus for determining the heat conductivity of fire-bricks and refractory materials. It is so constructed that any fire-brick of approximately standard dimensions, or similar piece of retort or other refractory material, can be placed in position and tested directly. Certain special features of design should, we think, secure accuracy and convenience in working.

A senior student has been carrying out for me an investigation on the influence of the oxygen dissolved in feed water on the corrosion of hot-water pipes and apparatus, by determining to what extent the oxygen liberated on heating the water is taken up by the metal of the apparatus. Definite and interesting results have been obtained.

Mr. Hodsman has carried further for me some experiments on the influence of lime on the amount of nitrogen in coal recovered as ammonia in distillation under determined conditions; and a senior student has continued experiments on the influence of varying proportions of lime on the fusibility of coal ash, as bearing on its liability to clinker. These two items are of special interest in connection with producer gas plants of the Mond type, in which ammonia is recovered. The use of such producer gas for heating gas-retorts and coke-ovens is one of the most interesting possibilities of the carbonizing process.

Diploma Courses.—In this, my first session as Livesey Professor, I have taken the lecture courses and degree and diploma regulations as I found them; but on the basis of the experience so gained, I have suggested certain modifications, which have been sanctioned by the University authorities. In the first place, the following alternative courses have been arranged for gas engineers or metallurgists who seek the University diploma, but cannot for any reason take the degree:—

(*a*) a three years' course, the same as for the B.Sc. degree; or

(*b*) a two years' course for students exceptionally prepared in general science; or

(*c*) a two years' course for students exceptionally prepared in technical subjects; or

(*d*) a four years' course to be arranged for students serving an apprenticeship or its equivalent in gas engineering or metallurgy. This course might occupy three days per week, or equivalent time for the first year, and at least two and a half days per week or its equivalent in the three succeeding years. A works' report in this case might be submitted for consideration in applying for the diploma.

(*a*), (*b*), (*c*), and (*d*) would lead up to the same diploma.

In explanation:—

(*a*) is the same as the degree course, but the matriculation examination on entry is not demanded, which meets the requirements more especially of students above the average age of entry, who have been in works.

(*b*) and (*c*) allow the period of study to be shortened to two years for a student exceptionally prepared by scientific study or by experience in a works laboratory or drawing office.

(*d*) is a marked innovation and responds to a demand which has found frequent expression in the past. It would enable a student to acquire a works and a University training during the period of apprenticeship; and I hazard the suggestion that gas engineers and works managers may be willing to ensure by this means that their pupils are receiving systematic scientific instruction by lectures and laboratory practice.

Special Lectures.—The times for these lectures have been altered so that two lectures are to be given on the Wednesday evening,

instead of one on the Wednesday evening and one on the Thursday morning. Interference with works routine is so reduced. The lectures given in the past on Saturday afternoons will, in future, be given on some evening to be determined.

Evening Laboratory Work.—The laboratory will be open for work on Wednesdays from 6 p.m. to 9 p.m. during the second term (when the special lectures are all given). This will make the equipment of the department available for qualified students who are unable to attend during the day, and laboratory instruction will be given in pyrometry, calorimetry, photometry, gas analysis, and other branches of gas-works testing.

The students attending will be expected to have made themselves proficient in these subjects and in general chemical work so far as the means provided by more local institutions allow. Since such laboratory instruction as is contemplated can only be given in a few of the largest works, the opportunity of obtaining it is exceptional, and, I am assured, is likely to be highly valued.

Degree Courses.—The degree course represents the best training which the University can give to a student of good general education who can spend three (or better, four) years in acquiring a thorough knowledge of the scientific principles of his future professional work. This is the course in which I believe our best work can be done.

(Signed) JOHN W. COBB,
Livesey Professor.

WORK OF THE SULPHATE OF AMMONIA COMMITTEE.

Agricultural Manurial Experiments.

WE propose from time to time to bring to the notice of our readers some phases of the work of the Sulphate of Ammonia Committee, and the advantages which are accruing to users of sulphate of ammonia in the United Kingdom. The work of the Committee is too well known to need definition here; but as its home propaganda section is proving of considerable value to all producers of sulphate of ammonia or gas liquor, it is thought that some account of the results obtained will be of interest.

Compared with the practice of agriculture, the use of artificial manures is a very recent innovation. Progress has, however, shown the necessity for, and the value of, artificials; and it now remains to ascertain the best combinations for various soils, crops, and conditions. A large amount of work has been done by various agricultural bodies without the special advantages and best methods of using sulphate of ammonia being brought out. It is one of the chief objects of the Committee to demonstrate to the farmer and gardener, by experiments carried out on his own land, the value of sulphate of ammonia, and thus overcome any remaining, but fast vanishing, prejudice against it.

These and the means they afford of coming into contact with agriculturists serve another valuable end—namely, the discussion of prices. Since nitrogenous manures advanced so greatly, farmers have questioned whether sulphate of ammonia is worth the price charged—saying they prefer to buy nitrate of soda at perhaps £2 per ton less. It is only when it is pointed out that sulphate of ammonia contains fertilizing material worth £3 to £4 per ton more than nitrate of soda, at current prices, that the advantage of buying sulphate is brought home. It has to be remembered that sulphate of ammonia contains about 20¾ per cent. of nitrogen against about 15 per cent. in nitrate of soda; and it is the nitrogen that has to be paid for.

Supervisors with a good practical knowledge of agriculture, and in many cases scientific training as well, are obtained by the assistance of the Agricultural Departments of Universities and Colleges and the leading Agricultural Societies. This season, 66 supervisors were engaged, each undertaking to obtain the consent of ten farmers in his district to carry out experiments on the crops most grown. Three plots of one-tenth of an acre are measured out and sown with manurial dressings supplied free by the Committee. Each centre is tested for lime, and should this prove to be deficient, the Committee provide what is required. As far as possible, fields adjoining frequented roads are chosen for the plots, and boards are erected calling attention to the experiment. A representative of the Committee visits supervisors, and goes with them to inspect the plots and see the farmers. The final report of the supervisor contains the weights of the crops, the increases due to the use of sulphate of ammonia, and an account of the farming conditions generally.

Other work of the Committee will be dealt with in subsequent issues.

GAS-COMPRESSING PLANT IN BELFAST.

DURING the meeting of the Irish Association of Gas Managers in Belfast last week (a report of which appears elsewhere), many of the members took the opportunity of inspecting the new compressing plant, which has been in operation for about a month, for high-pressure gas lighting. The plant, which was erected in an old workshop belonging to the gas undertaking, compresses gas for the high-pressure lights in Donegall Street and around the City Hall, a description of which was given by Mr. Cleland at the meeting of the Association last year. [See "JOURNAL," Vol. CXIX., p. 183.] Universal admiration has been expressed for the beauty of the light; and the Corporation fear that there will be a general demand for an extension of the system to all parts of the city, which they cannot afford to meet.

The compressors, which are in duplicate, are of the Waller

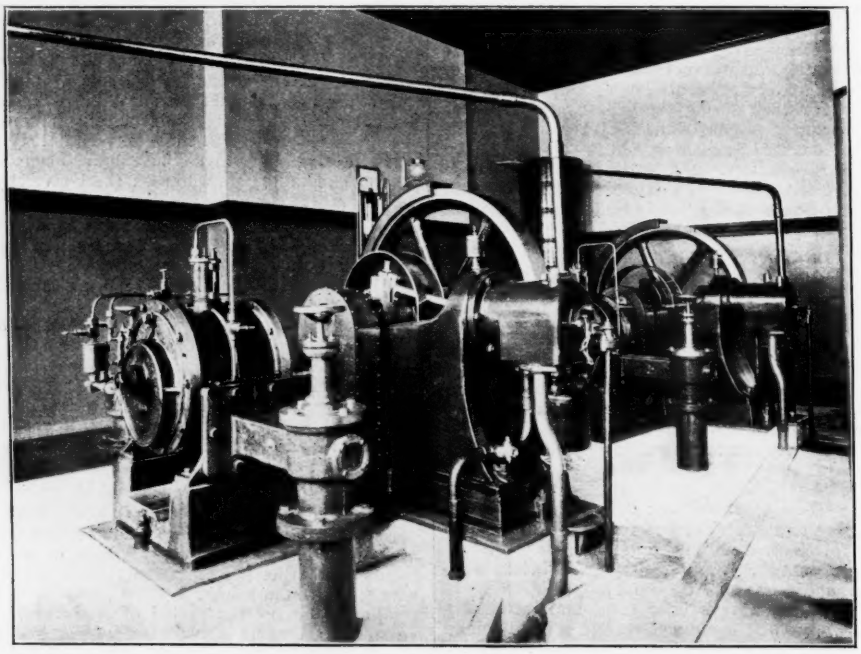


Photo. by A. Welch.

THE GAS-COMPRESSING PLANT FOR THE HIGH-PRESSURE PUBLIC LIGHTING OF BELFAST.

three-blade type, each capable of dealing with 10,000 cubic feet of gas per hour. The gas is raised to a pressure of 5 lbs. per square inch. Each machine is fitted with a complete system of automatic forced lubrication. The power is supplied by 7 B.H.P. gas-engines, geared with raw hide pinions. A steady outlet pressure is maintained by the Hulton reducing governors. There is a receiver before the outlet governors; so that, in the event of a sudden breakdown in one of the engines, pressure could be maintained for a few minutes while the other was being started-up. This could be effected very quickly, as the spare engine is always kept ready; and with the magneto ignition, starting is a simple operation.

PURIFYING GAS BY HEAT.

The Carpenter-Evans Process.

WRITING in the "Co-Partnership Journal" of the South Metropolitan Gas Company, Mr. W. T. Layton has this month a very interesting chapter of the history of gas purification. We reproduce it, by permission, together with the photographic illustrations kindly lent for the purpose.

In the very early days of gas lighting—the days when its most common rivals were the guttering tallow candles and the smoky lamp which imperfectly consumed inferior qualities of oils—the question of purification was not a very acute one, and coal gas, like the quality of mercy, was not strained. From the retort to the burner was but a short step, not barred by any complex devices for purification. The crude gas, consumed in an equally crude burner, yielded "sweetness and light" in comparison with the illuminants which it displaced. But it soon became evident that the cause of gas illumination would be much advanced if means could be found to remove certain unnecessary and, indeed, objectionable constituents of gas—notably the compounds of sulphur. The first use of lime for removing sulphur was by Clegg in 1804, at Sowerby Bridge, near Halifax. Up to this date the only purification process that had been tried would seem to be that of washing with water. Clegg's process was simple, but ineffective. He put some lime in the gasholder tank, where it settled on the bottom and made practically no difference to the gas. This fact was recognized by Clegg during the following three years; for at the end of that period he devised a paddle for stirring-up the lime in gasholder tanks. This may have resulted in an infinitesimal improvement—for a time. However, the mind of Clegg had seriously been turned to the subject of purification; and within a year his paddle had been superseded by a separate purifier—first used at Stonyhurst College, the purifying medium being "wet lime."

Writing in 1815, Frederick Accum, Operative Chemist, and one of the Directors of the "Chartered" Gaslight and Coke Company, throws a ray of light on the primitive processes of the early gas-works :—

> The manufacture of the coal gas requires nothing more than what the most ignorant person, with a common degree of care and attention, is competent to perform. . . . The diversified experiments which have been made by different individuals, unconnected with each other, have sufficiently established the perfect safety of the new lights; and numerous manufactories might be named in which the gas-lights have now been in use for upwards of seven years where nothing like an accident had occurred, though the apparatus in all of them is entrusted to the most ignorant man.

This deliberate and evidently sincere expression of the opinion of a lecturer on Applied Science reads strangely in these days, when gas-works are equipped with chemical and physical laboratories and University degrees are conferred in gas engineering.

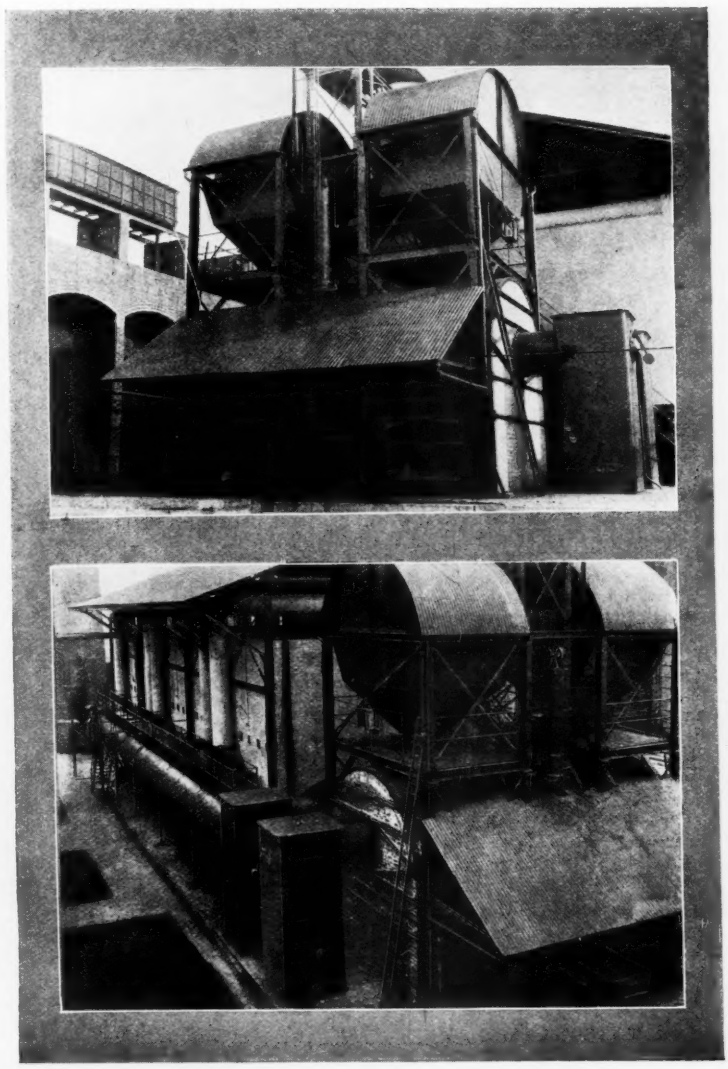
To trace even briefly the history of purification and the researches in connection therewith would take much time and space. During the century that gas lighting has been reckoned among the industries of the world, purification from sulphur compounds has almost always and everywhere been effected by lime or oxide of iron, or both. The important sulphur compounds existing in gas as it leaves the condensers are sulphuretted hydrogen and carbon bisulphide, the former of which is readily taken up by lime and iron oxide. Carbon bisulphide has troubled the gas engineers of at least three generations to a very considerable extent. Sir George Livesey said in 1874:

> This sulphur bugbear has of late made the lives of many gas managers, who have spoken to me on the subject, a perfect burden to them; and I speak feelingly, for it has caused me more annoyance than all other things put together.

The "sulphur clauses," under which the Metropolitan Gas Companies were compelled to keep the sulphur in the gas they supplied below a certain maximum, were very burdensome—especially to the engineers who had the charge of works in populous localities. Purification by lime was the only way that was commercially available for bringing the sulphur content down to the standard; and the odours of the spent lime were strongly objected to by neighbouring residents. For evidence of this it is only necessary to refer to the early years of the Old Kent Road works. On March 17, 1837, the inhabitants of the district met together and passed a resolution expressing an opinion that "the South Metropolitan Gas Company by permitting heaps of sulphuret of lime . . . to accumulate on their premises . . . are endangering the health of the neighbourhood, and by so doing have materially injured the property of the vicinity." This is a fairly accurate statement of the attitude of "the man in the street"—especially in the street near the gas-works—concerning the use of lime for purifying gas. In the days of the "sulphur clauses," gas companies were between the Referees and the deep indignation of local residents. To comply with statutory requirements, they must make their works a public nuisance—a place which one could smell half-a-mile before he got to it and for several days afterwards. Small wonder that Sir George Livesey led a successful agitation for the abolition of the troublesome restrictions.

But the abolition of the restrictions did not settle the sulphur question. The gas-consuming public, reasonably or unreasonably, demand a gas free from sulphur. That the evils of the trace of sulphur which remains after oxide purification have been greatly exaggerated by interested persons is beyond dispute; but in the face of business competition, gas companies (like other traders) have to meet the requirements of their patrons. No Act of Parliament is more exacting than the exigencies of competitive trading.

It is something more than a coincidence that the Company which was prominent in obtaining relief from stringent legal obligations should now be in the forefront of a movement to achieve more than the law ever demanded or expected. It is proof, if proof were needed, that our Company is fully alive to the interests and even the wishes of its consumers. For many years persistent efforts have been made to bring our gas to the highest degree of purity



Carbon Bisulphide Plant at the Old Kent Road Gas-Works.

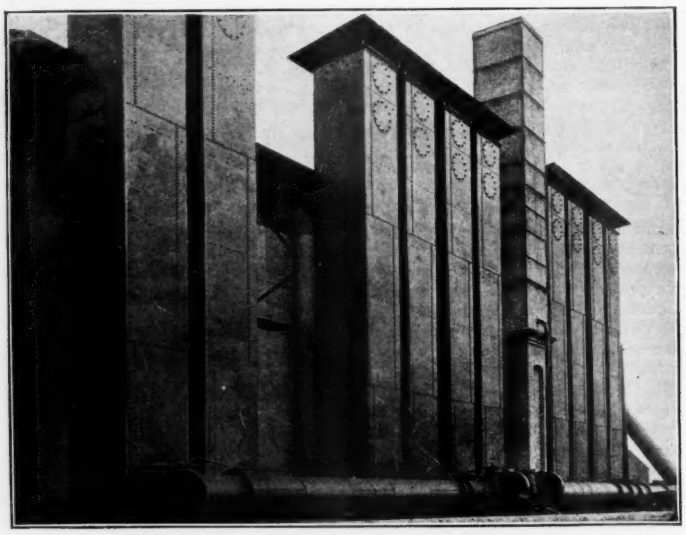
that was commercially attainable; and the knowledge and skill of our chemical staff have been directed to the breaking-up and removal of carbon bisulphide. The result of these researches was made public by the Chairman in his paper read a few weeks ago before the Société Technique de l'Industrie du Gaz en France.

Briefly stated, the result is that the purification of gas from carbon bisulphide by means of heat is proved to be practicable from the commercial as well as the chemical standpoint. The long and careful course of experimental work by our Chief Chemist, Mr. E. V. Evans, has culminated in the construction and successful working of a plant capable of dealing with 10 million cubic feet of gas daily. From this great volume of gas, the apparatus will remove about 80 per cent. of the sulphur which remains after ordinary purification.

The idea of purification by heat is not a new one. Dr. Carpenter told the Société Technique that as far back as 1819 George Holworthy Palmer, subsequently the first Engineer of the Old Kent Road works, made experiments in this direction at the Macclesfield Gas-Works, but without success. Other workers in this cause, to whom credit was given, were the Rev. W. R. Bowditch (1854), Alfred Kitt (1861), George Bower (1863), Professor A. G. Vernon Harcourt (1871), J. & F. W. Clark (1878), J. von Quaglio (1879), and E. L. Hall, of Portland, U.S.A. That carbon bisulphide could be broken up by heat was well known; the problem which had to be solved was how to do it without injuriously affecting any of the more valuable constituents of the gas, and at a cost which was not an unreasonable addition to the costs of purification. To attain these objects it was necessary to discover the lowest temperature which would do the work thoroughly; and recourse was had to catalysis—a beautiful and important action concerning the theory of which scientific men are not all agreed, although they are unanimous in their use of its Greek name. For the purpose of a popular article like the present, it may be sufficient to explain that in some chemical processes the reaction is greatly facilitated by the presence of a substance which does not undergo any change itself, but in some mysterious manner induces a condition favourable to the reaction of the other bodies present. Such a process is spoken of as "catalysis" or "catalytic action," and the substance which is used to induce it is called a "catalyzer."

After it had been proved that carbon bisulphide could be broken up by catalysis, further research indicated that the best catalyzer was reduced nickel; that a temperature of less than 500° C. was sufficient for the purpose; and that a great advantage in working resulted from heating the gas before it came in contact with the catalyzer.

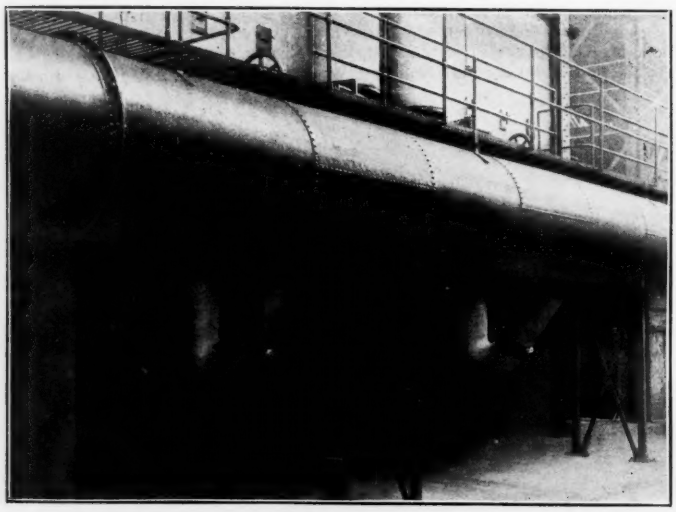
The illustrations which accompany this article are from photographs of the apparatus at Old Kent Road. A few sentences will suffice to describe the process. The heat is obtained from producer gas. The coal gas to be treated is first passed through preheating tubes, which raise it to the necessary temperature, and then it is brought in contact with fire-clay balls, about an inch in diameter, impregnated with reduced nickel, and heated to about 430° C. (a little below the boiling point of sulphur). The result is that the carbon bisulphide is broken up into carbon and sulphur; the carbon is deposited on the catalyzer, to be afterwards burnt off; and the sulphur immediately unites with some of the hydrogen in the gas to form sulphuretted hydrogen, which is removed by an oxide purifier. Neither the illuminating nor the heating properties of the gas are injured by the process.



The Heat Interchangers.

That purification by heat is a success is now beyond the possibility of doubt. Some editoral remarks in the "Journal of Gas Lighting" for July 1 are emphatic on this point:—

> The important thing is success has been achieved—not only on the laboratory scale, but on two working-scale plants, one of which represents a daily treatment of gas of about 10 million cubic feet. A large measure of the honour for success Mr. Carpenter awards to Mr. E. V. Evans, the Company's Chief Chemist, though the encouragement, personal interest and work, and the boldness born of confidence of the Chairman of the Company have played an incalculable part in the development and the success. The task attempted was not one that would have succeeded in the hands of anyone who allowed difficulties to promote discouragement, or who was not bold enough to go forward into working scale trial when ultimately successful laboratory work had carried conviction that the reward was within reach. The workers of the South Metropolitan Company do not by any means claim that they were the first in the field in proposing to effect the purification of gas from sulphur compounds by heat. . . . But they do claim, and they have a right to claim, that they are the first to bridge, by experiment and discovery, the wide gulf between former knowledge and practical working on lines producing a large efficiency, at little trouble and expense per 1000 cubic feet of gas.



The Producer Gas Supply.

In a lecture delivered in June, 1872, to the members of the British Association of Gas Managers, Dr. Odling referred to Professor Vernon Harcourt's suggestion for the application of heat in the elimination of sulphur compounds from gas, and remarked that Mr. Harcourt was convinced that it would prove successful on a manufacturing scale, but the uniform heating or re-heating of any considerable body of gas was usually

The Engine-House.

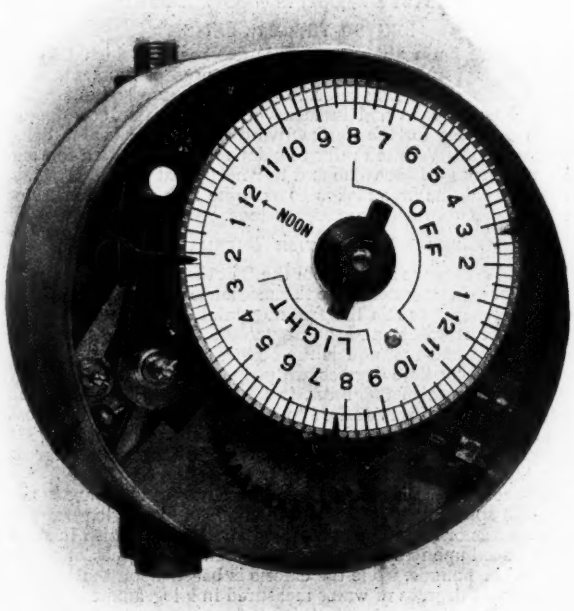
a matter of difficulty in practice. Now, after forty years, the difficulties have been overcome and the anticipations of Vernon Harcourt have been justified. But, as the "JOURNAL OF GAS LIGHTING" justly remarked, the result has been attained by "dogged determination to achieve success" in the face of many difficulties and frequent disappointments,

AUTOMATIC PUBLIC LIGHTING APPARATUS.

The "London" Lamp Controller.

AT this time of day, it is unnecessary to emphasize the saving that can be effected in public gas-lamp consumption by the use of efficient means of automatic lighting and control—simultaneous lighting giving to gas-lamps an advantage hitherto exclusively claimed for the electric light.

The Auto Lighter, Limited, of No. 39, Victoria Street, S.W., are introducing, under the title of the "'London' Lamp Controller," a very ingenious clockwork arrangement about which they remark: It is probably impossible to obtain perfect synchronization, but in this respect a great deal depends upon the amount of work—apart from merely keeping time—which the clock mechanism is called upon to do, together with the general construction (particularly as regards class of material and workmanship) of the apparatus. In the second place, the regulating and setting of the apparatus should be accurate yet simple. Other important features requisite to an ideal clock controller are that the operation of lighting and extinguishing should not be too long nor too short—not too long, because, besides the obvious waste of gas incurred thereby, there is also the danger of the burner lighting-back, and not too short because a permanent pilot is then necessary, and there is again the danger of the burner lighting-back. Too quick lighting, moreover, is liable to give a shock to the mantle. Also the operation of winding should not affect in any way any other part of the mechanism of the apparatus. The apparatus must further be insect and dust proof.



"London" Lamp-Controller, with Cover removed for Winding.

The appliance (the invention of Mr. C. R. Oliver) was described and illustrated in our "Register of Patents" for Jan. 14 last, p. 114; so that any detailed account of its working is now unnecessary. It may, however, be pointed out that the controller is the result of many years' experience in automatic lighting; and, in principle, it is different from any other clock controller on the market. Samples, we learn, have already been working on public lamps "with great satisfaction for some time."

Briefly, the apparatus consists of a clock and gas-tap mechanism. The latter consists of a separate train of wheels, which are released in readiness for action a short time before the pre-determined time of action by means of a two-armed lever actuated by pins carried by the moving dial. The working of the apparatus is not affected should the lamp-post and controller be out of the perpendicular; and it is not possible for gas to leak into the clock mechanism. When fixed in the lantern, the whole apparatus is enclosed in a dust and insect proof case the cover of which needs only to be removed when it is desired to alter the times for lighting and extinguishing. The size of the controller, which fits well down into the lantern, is only 3½ inches by 2 inches; so that there is no shadow cast. A lever is provided for working the mechanism by hand when renewing mantles.

It is claimed for the apparatus that synchronization of the clocks in actual working has been achieved as nearly as it is possible to do so; this important essential of a clock controller being partly due to the apparatus being so constructed as to limit the work of the clock mechanism to keeping time only, and partly due to the construction of the dial permitting practically perfect setting.

The dial is the subject of a separate patent; and the ease and accuracy with which the controller can be set is one of the features of the apparatus. No screws, nuts, or parts are required to be loosened or tightened-up in this operation; and the working of the clock is not affected in any way by altering the pointers of the dial. Moreover, the altering of one pointer cannot affect the position of the others.

Another distinct and important feature of the "London" controller is the gas-tap. This is operated by a second train of wheels independent of the clock mechanism, and is constructed so that the pilot light is automatically turned off when the burner is lighted-up. The mechanism runs for some seconds during the operation of lighting or extinguishing—thus giving plenty of time for the burner to light before the pilot jet is extinguished. But, owing to the special formation of the gas-tap, the actual lighting or extinguishing is practically instantaneous—neither too fast nor too slow. There is thus no chance of a shock being given to the mantle.

All the taps are gas tight without the application of grease or other matter, and can safely be used with high-pressure lighting. They can also be used with flash-light burners, and are likewise suitable for either upright or inverted burners with ordinary or swan-neck standards.

By a simple adjustment, the controller can be adapted for lighting and extinguishing "cluster" burners—that is to say, the burners being lighted-up simultaneously at lighting time, one or more can be extinguished at midnight or at any other desired time, the remaining burner or burners being extinguished at any later pre-determined time. It will thus be seen that it is not necessary to provide several types of apparatus for each special lighting arrangement.

"Bulletin" of the Belgian Gas Association.

We have received from the Secretary of the Belgian Association of Gas Managers (M. Emile Van Helde, the Manager of the Molenbeck-Koekelberg Gas-Works of the Imperial Continental Gas Association) the "Bulletin" for 1912-13—the thirty-fifth year of the existence of the organization. Our readers may remember that the Association issue periodical "Bulletins" containing the papers submitted at the meetings and interesting matter obtained from outside sources. The volume to hand consists of five such issues, extending from October, 1912, to June, 1913. Their contents have been noticed from time to time as they have appeared, with the exception of the last. This contains an account of a discourse on the enrichment of gas by M. Degand, the Manager of the gas supply of Louvain, and a note by M. T. A. Vander Willigen, the Continental representative of Messrs. Humphreys and Glasgow, Limited, on "The Enrichment of Coke-Oven Gas by Carburetted Water Gas." It is followed by a communication submitted to the Association by M. Salzenberg, a former manager of gas-works, on the "Mont-Cenis" process for the recovery of sulphate of ammonia. With the view of making the information in regard to this subject as complete as possible, a few particulars are also given of the Koppers, Burkheiser, and Feld processes. The miscellaneous subjects include a translated extract from Professor Lewes's lecture to the British Commercial Gas Association at Manchester last October. The technical matter in the volume is fully illustrated by diagrams, plates, and reproduction of photographs; and an effective reproduction of the Association's medal serves as a frontispiece. Lists are given of all the towns and communes in Belgium which are lighted by gas, and of the gas companies carrying on undertakings in the kingdom. The book contains a valuable collection of technical matter, which is very creditably presented by the publishers, the Établissement Emil Bruylant, 67, Rue de la Régence, Brussels.

Iron and Steel Institute.—The autumn meeting of this Institute will be held in Brussels from the 1st to the 4th prox. Among the papers to be submitted for discussion are the following: "Coke Manufacture in Belgium," by Baron E. Coppée; "Distillation of Tar in Metallurgical Practice," by M. Gevers-Orban; "Use of Coke-Oven and Blast-Furnace Gases in Metallurgy, by M. Houbaer.

Mr. Goodenough's Cantor Lectures.—The current number of the "Journal of the Society of Arts" contains the first of the two Cantor Lectures on "Coal Gas as a Fuel for Domestic Purposes," delivered by Mr. F. W. Goodenough, the Controller of Sales of the Gaslight and Coke Company, before the Society in March last, and fully noticed in our columns at the time. The two lectures will probably be issued, as is usual in the case of the Cantor Lectures, as a separate pamphlet.

IRISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Belfast.

THE Annual Meeting of the Irish Association of Gas Managers was held in the City Hall, Belfast, last Tuesday—the PRESIDENT (Mr. W. H. Roberts, the Gas Engineer and Manager of the Newtownards Urban District Council) in the chair. The City Hall is a magnificent building, both inside and out, and a fine and lasting testimony to the success of the municipal gas undertaking, which has contributed, and is still contributing, large sums of money towards its cost. The attendance was good; some seventy members, besides several ladies, being present at the opening of the proceedings.

A CIVIC WELCOME.

The LORD MAYOR (the Rt. Hon. R. J. M'Mordie, M.A., M.P.) took the chair at eleven o'clock. In welcoming the Association to Belfast, he remarked that, though the meeting was chiefly for business purposes, he was delighted to see some ladies, because they were always an addition to any gathering. He was only sorry they were not present in greater numbers. He welcomed the members most heartily to the city, and hoped they would enjoy their visit thoroughly. On the subject of the gas-works, he was unfortunately not qualified to speak. But whenever he heard competent opinions expressed on them, they were always in the most favourable terms; and it was a recognized fact that the undertaking was a great success. This he knew was very largely due to the energy, intelligence, and capable management of the Engineer (Mr. James D. Smith). In conclusion, he remarked how glad every one in Belfast was to see the Association, and no one more than he. He hoped the visit would be enjoyable, and leave a lasting, pleasant recollection on the minds of the members.

The PRESIDENT proposed a vote of thanks to the Lord Mayor for the honour and kindness he had shown to the Association in being present to welcome them.

Mr. P. J. FITZPATRICK (Maryborough), the Vice-President, seconded the motion; and it was carried by acclamation.

The LORD MAYOR, in returning thanks, said that, though votes of thanks were customary on these occasions, he was most gratified by the enthusiasm with which this one had been received. A pleasant ceremony, he continued, had been entrusted to him. It was to present the medal of the Association to Mr. Roberts, the President; and he did this with the greatest pleasure.

The PRESIDENT briefly thanked the Lord Mayor and the Association.

GENERAL BUSINESS.

The PRESIDENT then took the chair, and the general business of the meeting was proceeded with.

COMMITTEE'S REPORT AND THE ACCOUNTS.

The HON. SECRETARY AND TREASURER (Mr. G. Airth, of Dundalk) presented the report of the Committee. It contained a brief review of the proceedings at the annual meeting held in Dublin last year, the papers read at which were attentively listened to and carefully debated. Great regret was expressed that no member had been prevailed upon to contribute a paper for the present meeting. This, the Committee said, was not as it should be; and they earnestly bespoke the consideration of the members for next year's meeting. There would be a lecture by Mr. Jacques Abady, and a paper by Mr. Docking, both of which, they were sure, would be interesting and profitable.

The HON. AUDITOR (Mr. G. W. Norman, of Dublin) presented the accounts, which showed that the year began with a balance of £55 4s. 5d., and closed with one of £67 11s. 10d.

On the motion of Mr. P. J. FITZPATRICK, seconded by Mr. JOHN RICHMOND, the report and accounts were unanimously adopted.

ELECTION OF OFFICE-BEARERS.

Messrs. T. DUNCAN (Glasgow) and J. O. SCOTT (Edinburgh), the Scrutineers of the balloting papers, reported the unanimous election of the following Officers and Committee for the year 1913-14:—

President.—Mr. P. J. Fitzpatrick, of Maryborough.
Vice-President.—Mr. J. E. Enright, of Tralee.
Members of Committee.—Messrs. R. Campbell (Carrickfergus), H. Kirkham (New Ross), and T. Hornby (Longford).
Auditor.—Mr. G. W. Norman, of Dublin.
Hon. Secretary and Treasurer.—Mr. G. Airth, of Dundalk.

NEW MEMBERS.

The following candidates for membership were unanimously elected:—

Members.—Messrs. A. S. Brook (Lisburn) and T. Stuart (Gorey).
Extraordinary Members.—Mr. George Hands, of London (Messrs. George Hands and Co.); and Mr. A. Docking, of Manchester (Selas Lighting Company, Limited).

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was given in the "JOURNAL" last week (p. 437).

THANKS TO THE PRESIDENT.

Mr. T. J. REID (Ballina), in moving a vote of thanks to the President, said Mr. Roberts was a practical man, and his address had been essentially a practical commentary on the state of affairs at the present moment, which all must agree was highly satisfactory. His remarks on vertical retorts had been some compensation to the Association for the failure of any member to read a paper on the subject; and they would, no doubt, furnish ample food for thought to those who had heard them. As one of the pioneers of high-pressure lighting in Ireland, Mr. Roberts was held in great esteem; and a visit to his works would, no doubt, be highly instructive.

Mr. JOHN TAYLOR (Coleraine) seconded the motion, which was carried by acclamation.

PRESENTATIONS OF PRESIDENTS' MEDALS.

The HON. SECRETARY AND TREASURER then informed the members that the Committee, at a meeting held the previous evening, had considered the question of presenting to Mr. J. G. Tooms, of Waterford, the President's Medal of the Association. [It will probably be remembered that Mr. Tooms will shortly be leaving Ireland to take up the duties of his appointment in Buenos Ayres.] He also proposed presenting the medal to Mr. S. B. Langlands, of Glasgow, another Past-President of the Association, who has not received the medal.

Mr. T. FRIZELLE (Holywood) seconded the motion.

Mr. NORMAN pointed out that Mr. W. A. Reid, who was President on the occasion of the Dublin meeting in 1901, had not received the medal.

Mr. J. RICHMOND having testified to this fact, the motion was amended so as to include Mr. Reid; and it was carried without opposition.

MR. ABADY'S LECTURE.

Mr. JACQUES ABADY (London) then delivered a lecture on

BRITISH THERMAL UNITS.

The lecture I am about to deliver deals with British therma units, and is, I think, opportune at the present moment, when Parliament is prescribing calorific standards expressed differently in nearly every case, and further when the relative economy of different systems for the destructive distillation of coal is being hotly debated. We often refer to calories and to British therma l units, to "gross" heat value and to "net" heat value. I think, therefore, that the first task is to examine into what constitutes the difference between these expressions.

CALORIES AND BRITISH THERMAL UNITS.

The first difference arises from the fact that there are in use in English-speaking countries two thermometric scales—the Fahrenheit, in which 32° equals the freezing-point and 212° equals the boiling-point of water; and the Centigrade, in which 0° equals the freezing-point and 100° equals the boiling-point of water. It follows that intermediate degrees are proportional, and an ordinary room temperature of 60° Fahr. is about 15° C. It should be remembered that if it is desired to convert an expression of heat value from one thermometer scale to the other, the factor 1·8 is employed. Thus, the latent heat of steam in Centigrade degrees is 537, but in Fahrenheit degrees it is 537 × 1·8, or 966.

The second difference arises from the fact that there are in use in English-speaking countries two methods of measuring water—*i.e.*, in pounds or in kilogrammes (litres). Now, a British thermal unit is based upon the heating in Fahrenheit degrees of water measured in pounds, while the calorie is based upon the heating in Centigrade degrees of water measured in kilogrammes. It will be seen that it is not an easy thing to measure water in pounds unless one weighs the water, which is a troublesome thing to do in a calorimeter, through which water flows in kilogrammes, were it not for the fact that there is a unit of volume—*i.e.* a litre—which coincides with a kilogramme (where the measurement of water at ordinary temperatures is concerned); and so we can easily measure the water flowing though a calorimeter by collecting it in a measuring-glass graduated in litres and fractions. This is the reason calorimeters are fitted with Centigrade thermometers and litre measures, though they may be used by someone who desires to express heating power in British thermal units.

It will be readily understood that every kilo-centigrade degree is termed a "calorie;" and it follows that to convert kilo-Centigrade degrees (calories) to pound-Fahrenheit degrees (British thermal units) it is necessary to employ a factor which comprises the relationship between the thermometer scales as well as the relationship between a kilogramme and a pound. A kilogramme is rather more than 2·2 lbs., so that the factor is 1·8 × 2·2, or 3·96. As a matter of fact, it is 3·968, or (say) 4; and this is the relationship between calories and British thermal units. Thus, 125 calories equal (say) 500 B.Th.U.

Of course, this factor refers to the expression of the heat of combustion of gas measured in the same terms (which in this

country is in cubic feet); but calorific power on the Continent is measured in terms of a cubic metre. A cubic metre contains 35·316 cubic feet; so that to convert calories per cubic foot into calories per cubic metre one multiplies by 35·316, and to convert British thermal units per cubic foot into calories per cubic metre one multiplies by 35·316 ÷ 4 or 8·9. I think familiarity with these simple factors (say, 4 and 9) will enable one to appreciate readily what it is intended to convey when one reads that a gas has (say) 5400 calories per cubic metre, and to compare it mentally with a gas of which the heat value in British thermal units per cubic foot is known.

"Gross" and "Net" Heat Values.

I have briefly dealt with a difference which is nothing more nor less than a method of expression. I am now about to deal with a difference which involves a question of principle, and is, I think, a matter upon which the gas industry should take a stand of no uncertain nature. The difference I refer to is "gross," or higher, heat units, as compared with "net," or lower, heat units. To put it briefly, the "gross" units represent (or should represent) all the heat generated by the combustion of a gas; while the net is this heat less a loss of about 10 per cent., due to the fact that the water formed from hydrogen containing gases remains in the form of vapour, and does not give up its latent heat unless the combustion took place under circumstances (as in a calorimeter) where the vapour is brought to a liquid state by condensation.

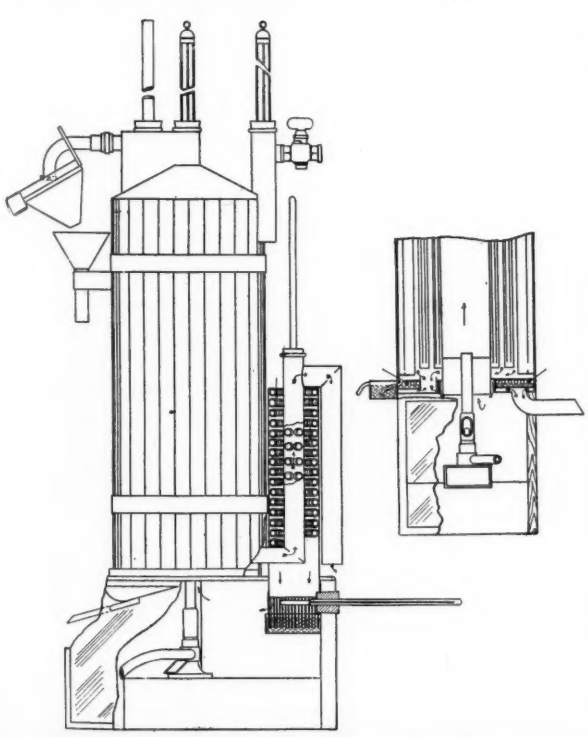
In a calorimeter, the steam formed by the combustion of hydrogen is condensed to water, and as it gives up its latent heat to the circulating water, what one gets (or should get) on a calorimeter is the "gross," or "total," heat value. To arrive at the "net" value, it is necessary to make a deduction based upon the condensed products collected. The latent heat of steam at 100° C. is 537°. But the water of combustion is usually raised and condensed from and to atmospheric temperature; and therefore an addition must be made to this figure.

It is usual to take an average figure of 600° assumed to be given up in the liquefaction of every kilogramme (1000 c.c.) of condensed products due to the combustion of one cubic foot of gas, and make a deduction from the gross for every cubic centimetre of 600 ÷ 1000, or 0·6 calorie.

It will be seen that the "net" heat value is something which is not shown by the calorimeter, and to arrive at which an arbitrary deduction from the calorimeter reading is necessary. And yet some folk say that, nevertheless, the "net" calorific power is the one that should be used. Seeing that the "net" does not express the heat that is actually in the gas, it seems to me to establish a precedent, and also to put a limitation to endeavours to construct apparatus which can use the "gross" heat for purposes not at present available. I therefore think that the "gross" is clearly the standard which should be prescribed in Acts of Parliament, and in which comparison should be made. This is a matter upon which the gas industry should make up its mind.

The "Total Heat" Calorimeter.

This brings me to another point which is very rarely thought of, very rarely even considered, but which is of importance in connection with calorific power measurements. I refer to the question as to whether any ordinary calorimeter gives a proper return of the "gross" calorific power of gas; and I think that I can show that it does not. I can also show you a form of calorimeter, called the "Total Heat" Calorimeter, which gives a proper return of the "gross" heat units, and is therefore called "total heat." Part of the heat contained in a gas is derived from the combustion of the hydrogen in it, the products of which condense at atmospheric temperature and at their quantum of heat due to the latent heat of liquefaction. Now, air passes through a calorimeter to support the combustion of the gas. The air when entering may contain only a small amount of water vapour; but when the products pass away, they are obviously saturated, because they have passed over the walls of the calorimeter which are wet, while, moreover, they are practically equal in volume to the air entering the calorimeter. They therefore take away some of the products of combustion of the hydrogen in the form of water vapour. Consequently, the amount condensed is less than it should be, and therefore the calorific power shown by the calorimeter is also less than it should be. How much less depends upon circumstances; but, under all practical working conditions, it is materially less. The "Total Heat" Calorimeter prevents by a very simple means the invariably low reading of calorific power. It only allows air to enter the calorimeter after it has been saturated; so that all the water vapour which the products take away the air brings with it, and so the gas is not robbed of its heat.



The Simmance-Abady "Total Heat" Calorimeter. [Two Forms.]

Incidentally, this calorimeter ensures that all the temperatures are balanced; and the air, the atmosphere, the cold water, and the outlet products are automatically kept at practically the same temperature without any adjustment. I think that, on a small scale, this calorimeter bears the same relationship to an ordinary calorimeter as does a No. 2 "Metropolitan" burner to the old argand, and that the definition of "total heat" should be substituted for "gross," with which, indeed, it should coincide, were it not for the circumstances I have pointed out.

Advantages of the Instrument.

The following figures deal with the question of the influence upon calorific tests of the air content and its water vapour, and show how the calorimeter described avoids losses due to this cause.

Contraction on Burning Gas with Air.

Constituent.	Per Cent.	Air Required. (Approx.)	CO_2 Produced.	Nitrogen Remaining (Approx.)
CO_2	3	0	3	0
C_nH_m	4	57	8	46
O_2	1	0	0	1 (*i.e.* O_2 in gas)
CO	10	24	10	19
CH_4	30	287	30	230
H_2	50	120	0	95
N_2	2	0	0	2
	100	488	51	393
		588	444	

Loss on contraction, 144
Products practically equal the volume of air less half the volume of gas.

If excess air or nitrogen is taken, this appears on both sides, and does not affect the above statements. Thus, if a cubic foot of gas is burnt with 7 volumes of air, and the products are condensed, the volume of products equals 6½ cubic feet. If a cubic foot of gas is burnt with 9 volumes of air and the products are condensed, the volume of products equals 8½ cubic feet.

Weight of Water Vapour in Saturated Air or Gas.

Temperature.	Grammes per Cubic Metre.	Grammes per Cubic Foot.
5° C. (41° Fahr.)	6·761	0·191
15° ,, (59° ,,)	12·712	0·360
25° ,, (77° ,,)	22·795	0·645

Assume 1 volume of gas and 9 volumes of air, gas saturated, air different per cent. of saturation, products always saturated, then the following are losses or gains due to water vapour passing away uncondensed. [Every gramme (cubic centimetre) of water vapour condensed yields 0·6 calorie per cubic foot.]

Temp.	Saturation of Air. Per Cent.	Water Vapour Entering. Grammes	Water Vapour Leaving. Grammes.	Loss. Grammes.	Loss in B.Th.U. per Cubic Foot. B.Th.U.
25° C. (77° Fahr.)	10	1·225	5·482	4·257	10·23
	20	1·806	5 482	3·676	8·82
	40	2·967	5·482	2·515	6·03
	100	6·450	5·482	0·968	2·32
15° C. (59° Fahr.)	10	0·684	3·06	2·376	5·702
	20	1·008	3·06	2·052	4·924
	40	1·656	3·06	1 404	3·369
	100	3·600	3·06	0 540	1·290

[The fourth line in each of the two sections of the above figures shows the conditions prevailing in a "Total Heat" calorimeter.]

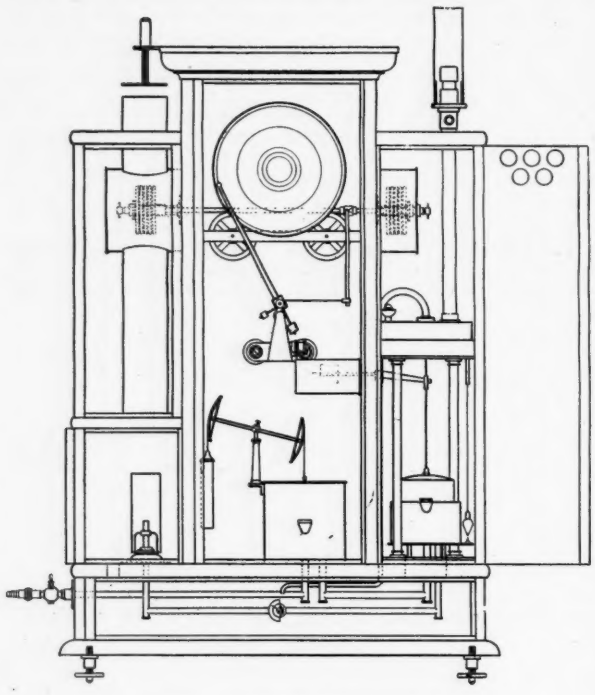
The above table assumes that the products leave the calorimeter at the same temperature as on entering. If they leave at a higher temperature, the loss in a calorimeter other than the one just described is greater, because the water vapour carried away will be more.

Recording Calorimeters.

The interest taken in calorific power has led to the production of recording calorimeters; and I therefore propose to deal with

some of the fundamental principles of such instruments. The basis of a recording calorimeter may be divided into three parts—firstly, the substitution for flowing water of some other medium to be heated, in order to obtain a record on a chart; secondly, the automatic compensation of the chart record for changes in atmospheric temperature and pressure which would otherwise call for the use of a tabular number; and, thirdly, the constant combustion of gas at an invariable rate independent of pressure and gravity.

In the instrument known as the "Calorgraph," the medium to be heated is air which passes over the two limbs of a differential recording thermometer. All the air, before it is heated, passes over one limb, and after it is heated over the second limb; and as these two have opposing effects upon a pen lever, the rise recorded is that due solely to the heating of the air by the gas, and not to a rise in the ordinary atmospheric temperature. It will thus be seen that, just as in a water-flow calorimeter, a heat unit is expressed in terms of water heated, so in the "Calorgraph" is the heat expressed in terms of air heated. If the instrument is arranged so that a certain rise of temperature coincides with a certain calorific power, the quantity of air in pounds which must be, and is, heated to produce this effect is easily ascertained, because the specific heat of air at constant pressure is practically independent of temperature.



Simmance-Abady "Calorgraph."

In the "Calorgraph," the specific heat at constant pressure is the one taken into account, because the pressure in the chimney varies so little as to make no appreciable difference in the specific heat of air. Assume that the instrument is arranged so that a rise in temperature of 60° Fahr. is equivalent to 500 B.Th.U., then the quantity of air heated (air = ·2374 specific heat) will be 500 ÷ (60 × 2374) = 35 lbs. That is to say, on this assumption, gas burning at the rate of a foot per hour heats up 35 lbs. of air, and thus shows itself to be of 500 B.Th.U.

Now, if temperature and barometer cause the gas to be expanded so that 1 cubic foot represents a less weight of gas than it would at 60° Fahr. and 30 inches barometer, it will be seen that the same cause is having exactly the same effect, and to an exactly proportional extent, upon the air to be heated, so that the expanded gas has less work to do in order to show 500 B.Th.U. That is to say, if the gas were expanded 50 per cent., so that 1 cubic foot per hour in volume was really only ⅔ cubic foot by weight, this would only have to heat air also expanded 50 per cent.; so that the volume, instead of being 35 lbs., would only be 35 ÷ 2 lbs. Thus the rise in temperature would be precisely the same in both cases, and so would be the record of the calorific power. It will be seen from this that the method of heating employed is one that automatically corrects the records to gas measured at normal temperature and pressure—*i.e.*, at 60° Fahr. and 30 inches.

The importance of this will be readily seen, because, supposing a 24-hour record is being examined, and the chart shows a drop or a rise from (say) midnight to four o'clock, one cannot know whether this drop or rise was due to an alteration in the atmospheric conditions, unless one knows what these conditions were. With the "Calorgraph," however, the record is automatically corrected, so the variations can be safely assigned to variations in calorific power.

It will be seen that the substitution of the use of a Centigrade-millimetre standard for normal temperature and pressure makes no difference whatever to the correctness (without any correction) of the chart reading of the "Calorgraph." The readings will be automatically corrected to 60° Fahr. and 30 inches, or 15° C. and 760 mm., or 0° C. and 760 mm., according to the setting of the instrument in the first instance.

Any interested person studying in detail this aspect of the "Calorgraph" will find that the relationship of British thermal units to pounds of air will be upset, owing to the acceleration of the air velocity up the combustion tube (a chimney, as it were) due to alteration in the heat of combustion of the gas. This is so, but the alteration follows a known law, being due to the difference in the densities of the air inside the "Calorgraph" (chimney, as it were) and outside. If the diaphragm temperature for a certain calorific power is 100° Fahr., and if the calorific power increases by 10 per cent., there would be an increase in the diaphragm temperature of 10 per cent. to 110° Fahr. if it were not for the increased velocity of the air.

The draught is dependent upon the difference between the densities of the air inside and outside the chimney; the density of a gas being inversely proportional to its absolute temperature (461° Fahr.). In other words, the velocity is proportional to the absolute temperature. Thus, in the example given above, the temperature, instead of being 110° Fahr., will be 108° Fahr. That is to say, the increase in calorific power would not cause a proportionate movement of the pen actuated by the diaphragm but for a tangential adjustment of the pen lever which speeds-up the pen, by which means it maintains a movement exactly proportional to increases in calorific power.

The third and final aspect of the "Calorgraph" is one which is of considerable importance in connection with the maintenance of the constant rate of gas for any purpose. It is well known that an orifice can be automatically opened and closed as the pressures falls and rises so as to deliver gas at its outlet at a constant pressure. Such a device is called a governor, and governors are simple and well known. It is equally well known that, given an orifice (as the space between a valve and its seating may be called) which delivers gas at a constant pressure, the amount which will pass through at that pressure will vary if the density or gravity of the gas varies. Now, it may be safely assumed that every change in the composition of gas is accompanied by a change in the gravity; and therefore the value of such a device as a recording calorimeter must be totally destroyed unless it can be ensured with the constant quantity passing, whether or not the gravity changes. If it were not so, it would mean that an apparent rise in calorific power was due to the fact that more gas was passing simply because it was lighter.

An Automatic Specific Gravity Recorder.

The production of an automatic method of gravity control is one upon which much thought has been expended, and it happens to have been my good fortune to be associated with Mr. Simmance in the invention of a method which, besides being utilized as a control with the "Calorgraph," can be applied either to control any gas flow or to indicate or record what the gravity is. I think I can possibly explain the principle more clearly by referring to a diagram of this specific gravity indicator, and then the way in which the simple principle is applied to controlling the flow in the "Calorgraph" will be very easy to follow.

The lecturer then proceeded to indicate the features of the Simmance-Abady "Gravitometer," which was described and illustrated in the "Journal" for Dec. 24, 1912, in an article by Mr. Abady, on "The Calorific Control of Gas Making," in which he furnished particulars of the other two instruments dealt with in his lecture.

Belfast Vertical Retort Gas.

At the close of his lecture, which was illustrated by a large number of lantern slides, Mr. Abady gave the following figures in regard to the composition of the gas produced in the vertical retorts at the Belfast Gas-Works:

	Per Cent.
CO_2	—
O_2	—
C_nH_m	2·4
CO	8·5
CH_4	31·0
H_2	53·8
N_2	4·3
	100·0

Illuminating power	15·5	candles
Calorific power, gross	586·8	B.Th.U.
,, ,, net	518·3	,,

The President, in proposing a hearty vote of thanks to Mr. Abady for his interesting and instructive lecture, said they in Ireland had many difficulties to meet, and one of them was not being able more often to listen to men like Mr. Abady.

Mr. W. Blair (Helensburgh), in seconding the vote, referred to the interest taken in British thermal units, which, he said, was increasing day by day. With the larger number of vertical retort installations, gas engineers were trying to get more and more heat units out of the coal they carbonized. The instruments described by Mr. Abady were of great use in all gas-works.

The vote of thanks was accorded by the members with hearty applause.

An adjournment was then made until two o'clock, for lunch in another room of the City Hall.

On the resumption of the proceedings,

Mr. A. Docking (Manchester) read a paper on "High-Pressure Lighting on the Selas Principle." This, with the discussion upon it, will be found on this and succeeding pages.

At the close of of Mr. Docking's reply, the President declared the business of the meeting at an end.

Thanks to the President.

A vote of thanks to the President, for the capable way in which he had conducted the meeting, was proposed by Mr. John Richmond, and received by the members with hearty applause.

Annual Dinner.

The usual dinner was held in the evening at Thompson's Restaurant, Royal Avenue. It was attended by a large gathering of members, visitors, and lady friends, as well as by six members of the Corporation. The toast-list opened with "The King," and the National Anthem was sung. Mr. Airth then proposed "The Belfast Corporation," and Councillor Squire responded. Councillor Riddle then gave "The Continued Prosperity of the Irish Association of Gas Managers," coupling with the toast the name of Mr. Roberts, who responded in an able speech. Other toasts were "The Ladies," "The Hon. Secretary and Treasurer" (Mr. Airth), "The Visitors," and "The Press." Between the speeches, songs and music were rendered by various members of the Association and ladies.

The Excursion.

Next day the members and visitors had an excursion. A start was made at 9.55 a.m. by train to Bangor, where brakes were waiting which conveyed the party to Newtownards, by way of Donaghadee and Grey Abbey; a stop being made at Ballywalter for luncheon. The drive was through very beautiful country, and in the fine warm weather everyone was in the best of spirits. At Newtownards, Mr. Roberts, the Gas Engineer and Manager to the Urban District Council, was host at tea in the Town Hall. Mr. Ferguson, the Chairman of the Council, in a few words gave the Association a cordial welcome. Mr. Lavery, the Chairman of the Gas Committee, then briefly traced the development of the gas undertaking since it had been a municipal concern, and warmly eulogised Mr. Roberts, who, in his thirteen years as Gas Manager, had, he said, in face of most adverse circumstances, increased the annual make of gas from 13 to 45 million cubic feet. Those who wished to do so were then given the opportunity of inspecting the gas-works; and the return journey to Belfast was made by train.

The Blackpool Gas Managership.

We learn that a Sub-Committee of the Gas Committee of the Blackpool Corporation nominated to consider the question of appointing a successor to Mr. John Chew, whose resignation of the position of Gas Engineer and Manager, after a service of more than half-a-century, was announced in the "Journal" a fortnight ago, have decided to recommend his son, Mr. William Chew, with Mr. John Chew, jun., as Assistant-Engineer. Referring to this matter on Wednesday last, the "Blackpool Times" said: "Mr. William Chew has had a thorough training in the duties appertaining to the management of the gas-works, having been associated for many years with all the developments of the undertaking. His son, Mr. John Chew, jun., who is a comparatively young man, has made a special study of the subject scientifically; and this, in conjunction with his practical experience obtained in connection with the Blackpool works, is regarded by the Sub-Committee as specially qualifying him for the position for which he is recommended." Mr. William Chew is not only a gas engineer, but is also a fully qualified electrical engineer; and the Sub-Committee are unanimously of opinion that they are doing the right thing, in the interests of the borough, in making the recommendations stated. The "Blackpool Herald," also commenting upon the appointment, remarked: "The family have a unique record for municipal service, and to the son and grandson, as to the father, due recognition of faithful and capable service is no more than deserved."

Mr. Samuel Joshua Cooper, of Mount Vernon, Barnsley, formerly a colliery owner, who died in July, left estate of the value of £751,446 gross—net personalty £706,627. Deceased, who had no family, left many charitable bequests.

We learn from the "Co-Partners' Magazine" of the Gaslight and Coke Company for the current month that a pleasing ceremony took place at the meeting of the Directors on the 11th ult., when the Governor (Sir Corbet Woodall, D.Sc.) asked, on behalf of the members of his family, the Court's acceptance of a replica of the portrait of himself, painted by Mr. Fiddes Watt, and presented by the staff on July 25, 1912. The original portrait hangs in the Governor's home at Chislehurst; and the replica will form a much-valued addition to the collection of portraits in the Company's Board-room.

SELAS SYSTEM OF LIGHTING AND HEATING.

By A. Docking, of Manchester.

[A Paper read before the Irish Association of Gas Managers.]

What I am called upon to do this afternoon is to read a paper on the "Selas" system, and to give what are considered points of advantage in its favour as compared with the modern systems of "high-pressure" gas. By high-pressure gas, I mean those systems compressing pure gas to 54 or 60 inches, and in some instances 80 inches, pressure. The 10-inch systems I shall not take into consideration; these being what the Yankee would term "back numbers."

The "Selas" system has not only made big strides abroad, on the Continent, and in England, but has made rapid progress in Ireland; the Company during the past two years having installed nearly fifty plants, many of them fairly large ones—two installations in Dublin alone amounting to nearly £3000. One of these now being installed for the Great Southern and Western Railway Company comprises four plants of 75,000-candle power each, and a large number of 1500, 1000, 500, and 200 candle power lamps, all of the outside type. This work is being carried out under the supervision of Mr. C. B. Outon, the Gas Engineer to the Company.

The Early Selas Gas and Air Apparatus.

It may be interesting before commencing the paper proper to give a little of the history of the Selas Lighting Company. The parent Company was first formed for the manufacture and sale of gas and air apparatus in the year 1894. In that year, they obtained patents for a gas and air apparatus, to mix and deliver gas and air at ordinary town pressure without the aid of any mechanical drive. The action of the apparatus was this: The gas was introduced at ordinary town pressure into a compartment or cylinder in every respect similar to an ordinary wet meter; the energy imparted to the drum by the ordinary town pressure being used to drive the other drum, which sucked in the air. The outlets of the two drums were coupled, and the mixture was passed on to the lights. This method of producing a mixture of gas and air would have been ideal had the pressure in the town main remained constant at all times; but trouble soon began when the pressure either decreased or increased. The greatest trouble was experienced by a drop in pressure, as the active force of the gas entering the drum was not sufficient to propel it. Several of these machines were sold, but had to be brought in.

The next patent was obtained in May, 1896, for an apparatus consisting of two drums as before, but comprisiug a small pump for increasing the air pressure slightly over that of the gas, and in passing both gas and air through separate drums as before. Trouble was again experienced by lamps flaming or going low consequent on the town pressure falling or one drum working more easily than the other. When these troubles were experienced, another patent was applied for, and obtained, in January, 1902, for an apparatus consisting of two drums, as before, and a piston pump for drawing the gas and air through the two drums and compressing the mixture up to 8 or 10 inches, or, alternatively, a double-acting piston pump was used with separate gas and air valves discharging into the same reservoir. The latter method was found to be far more successful than any of the three previous ones; and the Company commenced to manufacture and put up numerous installations. Again trouble was experienced. This time the pump was found to be the cause of the trouble. Like most piston pumps, whether driven by water or transmission, they were uncertain in their action, caused by numerous reasons—packing becoming hard and thus tightening the piston rod, glands leaking, and rings and valves sticking.

In August, 1903, another patent was granted for a new design of piston pump, with a mixer of practically the same design as the one at present in use—thus dispensing with water-drums, which had always caused so much trouble. This type of machine worked far better, and gave more satisfaction to users, than the previous ones. But it still had defects which showed themselves at most inopportune times; and the attention required of skilled mechanics after they were fixed was detrimental to their being adopted generally.

About this time great attention was being paid to high-pressure pure gas; and the Selas Company commenced to experiment in this direction. Not finding much success attending their efforts, however, they again reverted to the gas and air; and in the same year—October, 1903—they applied for, and obtained, the patent for an apparatus which eventually proved to be a commercial success, and which is practically the same in every respect as the present one. These nine years of experimenting cost the Selas Lighting Company about £30,000; and had the Company during that time experienced any financial difficulties, I think I am safe in saying the gas and air system would be unknown to the world to-day. The Company are now reaping some reward for their patient and persevering efforts to make it a success—as will be gathered when I say that the Company have at the present time offices and works in England, France, Germany, Sweden, and the United States of America.

The Working of the Selas Lamp.

I hope these few remarks by way of introduction have been interesting to you. I will now endeavour to explain as briefly

as possible the working of the Selas plant, and afterwards the advantages we claim for it. The system, which is protected by a number of patents all over the world, consists in thoroughly mixing a pre-determined quantity of gas and air, which for lighting purposes is usually one-and-a-half to two of air to one of gas, by means of a special apparatus producing a mixture of a definite and invariable composition at a constant pressure. The apparatus consists of an atmospheric governor, a mixing valve, a pressure governor, and a rotary compressor—all of which work sympathetically.

The action of the apparatus is as follows: The town gas enters the gas-governor, and is reduced to atmospheric pressure when it enters the mixing-valve, which forms a second control. The air enters the opposite port, where it comes in contact with the gas. The mixture, now being of a definite composition, is drawn into the compressing part of the plant, where it is compressed to, usually, 10 inches, or any desired pressure. The composition of the mixture is determined and regulated by means of a pin which actuates the mixing valve. When the mixture desired is obtained (which can be instantly detected at the trial burner), the pin is made fast by means of a locking nut. This valve can be taken out quite easily for cleaning purposes and replaced in a few moments by any unskilled man. The apparatus, although intricate to explain, is in actual use very simple to manipulate. The power required to drive the apparatus is as follows:

Candle Power.	Horse Power.	Candle Power.	Horse Power.
7,500	¼	40,000	¾
10,000	¼	50,000	1
15,000	½	60,000	1
20,000	½	75,000	1¼
30,000	¾	125,000	3½

The lamps in use with the system are of the following candle-power:

Candle Power.		Cubic Feet Per Hour.
75	guaranteed to consume no more than	1½
100	,, ,, ,, ,,	2
200	,, ,, ,, ,,	4
300	,, ,, ,, ,,	6
500	,, ,, ,, ,,	9
1000	,, ,, ,, ,,	17
1500	,, ,, ,, ,,	25
2250	,, ,, ,, ,,	38

All lamps are made of enamelled steel, unless copper is specified. The small unit lamps have brass fittings throughout, including the preheater. The larger and outside type of lamps all have cast-iron preheaters. The nipple and regulator are accessible from the outside of the lamp cases. If desired, the lamps can be supplied with a special fitting, enabling them to be lighted with an ordinary lamplighter's torch, in case of failure of the bye-pass. The mantles are of the Ramie, Plaissetty, and artificial silk type, and are fastened securely on the tapered burner-nozzle by means of a hardened brass bayonet clip. We have found by practical experience that this is preferable to the clay mantle-holder, owing to the latter cracking when subjected to intense heat, especially with the larger type of lamp.

For small unit lighting in factories, workshops, &c., we always use wire cages where we can; these being far more serviceable than globes. For the outside lamp, we employ the ordinary wired globe, only spherical instead of pear-shaped. We find by actual experience that these have a longer life than the pear-shaped globe, owing to the more equal expansion and to the fact that the flame from a broken mantle cannot impinge on the side. We find the ordinary existing piping quite suitable after it has been thoroughly cleansed of dust by blowing air at high pressure through it. We always do this before putting up the lamps; it saves trouble afterwards. As regards new piping, we advise the putting in of the same size pipes and fittings as would be used for low-pressure gas.

THE SELAS LIGHTING IN THE "Y.M.C.A." READING-ROOM, BELFAST.

The Advantages Claimed.

With this brief description of the system, I will now pass on to deal with the advantages claimed. In the first place, taking the hygienic advantage. The system is undoubtedly the most hygienic of any form of artificial light produced. Owing to the perfect mixture of gas and air, the combustion is complete, thereby rendering the atmosphere much purer than is possible with other forms of high-pressure lighting, which, in order to obtain combustion, draw in at the burner all the air that is required from the interior of the room. With the Selas system, having already taken a part of the air necessary from the exterior of the building, the atmospheric conditions are consequently more hygienic—an advantage which I think you will agree is particularly appreciated in a crowded workroom.

The following table, showing the comparative figures, will be interesting; water vapour being purposely ignored (to simplify). The figures given are all fair averages; the consumption in each case being dependent upon the quality of the gas supplied. In some instances it is lower, and in others higher; but in no case does the consumption of the 100-candle power Selas lamp exceed 2 cubic feet per hour. Analyzing the figures, therefore, it will be apparent that, candle power for candle power, the temperature of the room would be 25 per cent. higher with compressed gas than with the Selas system, also that 44 per cent. more air is extracted

Burners. Basis 100 c.p.	Consumption of Gas in Cubic Feet.	Heat Evolved by Combustion of Gas 550 B.Th.U. per Cubic Foot.	Cubic Feet of Air Extracted from Room for Complete Combustion.	Cubic Feet of Carbon Dioxide Discharged into Room per Hour.	Gas Consumed, Heat Evolved, and Carbon Dioxide Formed.
					Per Cent.
Flat-flame .	35	19,250	210	245	100
Incandescent upright .	5	2,750	30	35	14·2
Incandescent inverted .	4	2,200	24	28	11·4
Compressed gas 54 to 60 inches .	2·4	1,320	14·4	16·8	6·7
Selas . . .	1·8	990	8·1	12·6	5·1

from the room, and over 25 per cent. more carbon dioxide discharged into it—thus vitiating the atmosphere.

Minimum Pressure Employed.

I think you will acknowledge this is a very important matter to consider when contemplating a new system of high-pressure gas lighting. In the first instance, where the pipes are already in they can be utilized with perfect safety, and the expense of laying new piping is obviated. The danger of consequent leakage is also avoided, as gas at 54 to 60 inches pressure soon plays havoc with the cocks or any movable fittings, in which case the saving in gas over the old system becomes more or less problematical. With the Selas system, working at a pressure of only 10 inches and the greater part of the volume of the mixture being air, the danger of leakage is practically *nil*. This is in itself a fact which cannot be too highly considered.

The Dust Trouble.

You will agree with me that this is the greatest drawback of all forms of high or low pressure lighting (particularly high); and I think I may safely say that our electrical friends have claimed more customers from this reason than any other. Do not think for one moment I am going to say that the Selas system will entirely obviate this trouble. This cannot truthfully be said of any system. What I do say, however, is that the Selas system is far preferable to high or low pressure gas in this respect.

The Selas mixture consists approximately of two parts or volumes of air to one of gas; the air being drawn in from the exterior of the building, as has already been explained. But should the atmosphere of the building be extremely bad, owing to excessive fluff or dust, the proportion of air is increased at the machine; so that—and this is most important—in the event of the air aperture at the burner becoming almost choked with dust or fluff, there is still a good light given off, with an entire absence of carbon deposit—a blackened mantle being unknown with the Selas system.

Greater Efficiency with Smaller Units.

With the small unit lamps—50, 75, 100, and 200 candle power—we claim, and guarantee, an efficiency of 50-candle power per cubic foot of gas consumed. This has never been obtained with any other high-pressure gas system. With our new 1912 pattern lamp, I recently obtained an efficiency of 102-candle power, for 1·8 cubic feet of gas. The test was taken on Manchester gas, which I believe has a reputed candle power of 14. The reason I give for this abnormally high candle power on such small units is the method of premixing the gas and air, and the greater area of the hole in the injector nipple.

The area of a 54-inch 100-candle power nipple is 0·1075 m.m, as against the Selas 0·916 m.m. In other words, the hole in the gas and air nipple is nine times larger than the 54-inch gas. In the case of the compressed gas, the energy given to the gas at the compressor is greatly reduced in overcoming the friction set up by the nipple, which, of course, tends to greatly lessen the induction of air; and no matter to what extent the pressure is increased the friction will increase at a greater rate, because to keep the consumption low the area of the nipple must naturally be less at the higher pressure. After the gas has passed the nipple, it must set into motion at least nine times its own weight of air, thoroughly mix them together, and move the mixture forward at a greater rate than that of the back-fire.

THE SELAS LIGHTING OF THE "Y.M.C.A." GYNMASIUM AT BELFAST.

When these facts are considered, it will be apparent that the chances of this being accomplished are very remote indeed. To somewhat verify these statements, I will refer to Mr. Cleland's paper read before this Association last year, [see "Journal" for July 16, p. 183] in which he gave a table of actual tests taken by himself of three Keith installations and three Selas installationss, which, on being analyzed, showed that though the Keith light gave 17 per cent. more candle power than the Selas system, owing to some 150-candle power lamps being in use, they used 75 per cent. more gas to obtain this 17 per cent. increase in illumination—a fact which needs no comment, as the figures were from actual tests taken by Mr. Cleland.

Maintenance Costs.

This is another important point to be considered when adopting high-pressure lighting—in fact, I may say the most important one—as if a system is installed and the consumer finds that the maintenance costs are more than the saving effected in his gas bill, he soon wishes the whole thing—well, in a very warm place. Our average mantle consumption for units of 75 to 300 candle power is usually two per annum. In the higher candle power units for outdoor use, the mantle breakage is generally five to eight per annum, and globe breakage is usually 1½ to 2 per annum. I see by Mr. Cleland's paper that in the lamps in use around City Hall, the mantle average was 24 per year, or an average of about 5s. 6d. per lamp per month inclusive. This is most excessive, and would not be tolerated by a private consumer under any circumstances whatever.

The chief reason of the higher cost of maintenance is, of course, due to the higher pressure, which undoubtedly increases the wear and tear all round. If an engineer could get as efficient results out of his boiler working at 10 lbs. pressure instead of 60, he would not work at 60, because his upkeep would be much less all round at the lower pressure.

More Uniform Light Through Entire System.

This has been illustrated in many cases where we have replaced high-pressure light. In one particular instance the light varied as much as 40 to 50 per cent. This I attribute to the fact that the minute adjustment required by the high-pressure small-unit lamps is not given proper attention by the ordinary unskilled man who is left to look after them; also that the small hole in the high-pressure lamp is much more liable to get choked with the small particles of dust from the interior of the pipes than in the Selas system, where the hole is approximately nine times larger, and through which the small particles can fall without doing any harm.

Premises Cannot be Thrown Into Darkness.

The most important claim we make for the gas and air system is that in no case is panic caused by the premises being thrown into utter darkness by the compressor stopping for any reason,

such as belt breaking, motor or engine failure, &c. The moment the compressor stops, the automatic bye-pass comes into action, immediately allowing sufficient gass to pass at town pressure to keep the lamps lighted; and under no circumstances whatever will the lamps be extinguished.

Heating.

We are now paying great attention to the application of the gas and air system for industrial heating; and during the past two years much progress has been made in this direction, both in the United Kingdom, on the Continent, and in the United States of America. We have applied the system successfully in engineering works, for high-speed steel furnaces, case-hardening furnaces, brazing, melting, &c., and in textile works our system is largely used for the heating of calendars, schreiners, and singers, with far more satisfactory results than could be obtained by means of compressed gas.

We have applied the system to calendars with bowls of 15 inches diameter with a blind hole of only 3 inches diameter and 6 feet long. To obtain the heat rapidly, it is necessary to consume 100 feet of gas per hour in this small space; and the hole being a blind one, the spent products of combustion have to make their exit where the burner enters—no secondary air whatever being admitted to the flame. The old method was to heat by low-pressure gas or air blast; a steam exhaust being used to suck-in the necessary secondary air and take away the products of combustion. I need hardly say that the drawbacks of this method were many. In the first place, steam had to be used, and, secondly, even if the regulation of the suction tap was carefully attended to, there was a great amount of heat drawn off with the spent products. The success which has attended our efforts in general heating has been so gratifying that we are opening this year a special heating department, laying down extensive new plants for the manufacture of heating appliances, and giving special attention to all classes of industrial heating.

In conclusion, I would like to say that a Selas apparatus has recently been fixed in the basement of this hall for the interior lighting of the Gas Offices; and by permission of Mr. Smith, I have had fitted up various types of large and small lamps.

DISCUSSION.

Mr. Jacques Abady (London) asking permission, as a visitor, to address the meeting, said he did not wish so much to criticize the paper as to put a few questions to Mr. Docking, with the object of eliciting more information from him on the subject of his paper. There were, he said, two points of view to the question—the actual and the comparative. First, he should like to know something as to capital costs. With the large nipple used in the system, it would seem that not only a large volume of gas would pass, but a larger plant altogether than usual would be required. Would not this entail considerably increased costs? Again, Mr. Abady agreed that working with a large nipple had great advantages. How was it then that the test burner which Mr. Docking had shown had three small nipples? It seemed to Mr. Abady that the system needed exceedingly delicate adjustment. It would be interesting to know whether it could therefore be run simply on a belt, using existing machines for power in factories, &c. As to the candle power figures given. How had these been obtained? It would be only fair to state this, whether with or without reflectors, horizontally or vertically, and, generally speaking, in favourable, average, or unfavourable circumstances. Mr. Docking had stated that 2·4 cubic feet of compressed gas were necessary to give 100 candles. This statement hardly seemed justified. The superheater in this system seemed to be used merely with the object of improving efficiency. Had Mr. Docking any figures showing comparisons of results with and without superheaters? Then there was the statement that "premises cannot be thrown into darkness," &c. Did Mr. Docking mean that it was a bye-pass lamp system, or what exactly did he intend to convey by this? In conclusion, Mr. Abady said that his remarks were not intended to be too critical, but only suggestive, and he considered Mr. Docking's paper not only suitable for the occasion, but clearly and concisely expressed.

Mr. George Airth (Dundalk) then read a letter of regret from Mr. C. B. Outon, of Dublin, who was President of the Association for the year 1911-12.

Mr. Outon enclosed in the letter the following remarks on the paper: As reference is made by the author to the erection of Selas installations now in progress at the Great Southern and Western Railway Company, perhaps a few descriptive remarks will prove of interest to the members. One of the installations is situated at the Company's Dublin Terminus goods yard at Kingsbridge, where the area to be lighted is about 33 acres, the maximum length being nearly half-a-mile. After experimenting with various sizes of units and heights of posts during the last four months, the lighting and efficiency were deemed so satisfactory that the Company decided to adopt the system. The height of post was approved to give a distance of flame 24 feet from ground level, and also 1500-candle power lamps for all the most important positions, with an average pitch of 140 feet. In this yard some twenty 1500-candle power lamps, and, in the subsidiary sidings, ten 1000-candle power lamps, will be erected. The goods store contains four roads and three loading platforms, and is 285 feet long by 135 feet wide. In this case a smaller unit of 500-candle power lamp has been adopted at 40 feet pitch, and twenty-four of the lamps are in course of erection. The exterior of these stores will be illuminated by means of a number of 200-candle power lamps for the use of carmen. It was originally intended to motor-drive the Selas compressor from the Dublin Corporation current; but the prohibitive cost per unit for such purposes caused the Company to adopt a small National gas-engine, the maintenance for compression being very considerably cheapened. The lighting of this goods yard and store, when completed, will doubtless be one of the best in the United Kingdom. At the Inchicore works of the Company, a second Selas installation in the two new carriage and waggon shops is rapidly approaching completion. These shops stand on an area over 2½ acres, and will be devoted to the construction and maintenance of carriages and waggons. Here it was decided to adopt a larger number of smaller units; and one-hundred 500-candle power lamps and ten 1000-candle power lamps will afford an admirable illumination. In the latter instance the compressors will be motor-driven; current generated from "Diesel" engines being used exclusively for power purposes.

Mr. G. Airth (Dundalk) said that recently in Dundalk they had a bazaar in connection with a church at which the Selas Company put in one of their installations, which consisted of eighty 100-candle power lamps and four of 250-candle power each. These were erected by the employees of his own Company; the compressor being fitted up by the Selas Company. He left the installation in charge of his head plumber, who was able to get out of it everything claimed by the Selas Company. Seven small mantles were broken during an eight days' run; and these were exposed more or less to a high wind. Only one mantle of the higher power was broken; and this was due to an accident in cleaning the globe. The bazaar was being held to pay for the electric light, which had already been installed in the church; and the reverend gentleman who presided over its destinies congratulated him very much upon the lighting they had at the bazaar, and said he would never have had electric light in the church if he had seen how well they could light up the bazaar with gas. He thought this was a recommendation well worth having as to the efficiency of the Selas system as experienced in Dundalk.

Mr. J. G. Tooms (Waterford) said he considered the paper a valuable one. Personally, he had no experience of the system; but he had no hesitation in saying that if he had any use for an economic method of high-pressure lighting, he should at the present moment be in favour of testing the Selas system. In his opinion, to have a paper read, and the details of the mechanism of the lamps explained as it had been there that day by Mr. Docking, was invaluable to the members of the Association. There was another feature that strongly appealed to him as regarded the system, and it was that he was personally aware that the Selas Company (he had no desire to give them an advertisement or to unduly praise them) would go into any town of their own accord and guarantee to any manufacturer or any large user of light, whatever method of lighting he might have—inverted low-pressure lighting, or Kern lighting, or any economic system of low-pressure lighting—the very material saving of 30 to 40 per cent. of the excess consumption. He considered any system that had been put on the market in this way was doing a great deal for the gas industry, and he thought it behoved all of them who had not yet got electric lighting competition to take advantage of such means in the economic use of gas before they were actually troubled with such competition. The Hon. Secretary had said that, had the people in his town known what the Selas system could accomplish, in one case at least, electricity would never have been adopted, and thus a valuable consumer would not have been lost. In his own case, he put in some years ago, purely for show purposes, an installation of Keith's high-pressure system. He had been fairly well satisfied with it; and it had achieved its purpose, inasmuch as it had shown the people of Waterford what could be accomplished with gas. He wished to strongly emphasize again that it behoved people in a town where the electric lighting competition was not yet felt to note the advantages of the most economical methods of using gas. He would like to ask Mr. Docking if the 750-candle power was the highest single unit that they could reach with the Selas system. To his mind, the claims for the system might be put on the top grade; and he could not help, for his part, judging from the copies and quotations that had been submitted to him by Mr. Docking's Company as to what they were prepared to give, feeling that these figures were very well founded.

Mr. S. B. Langlands (Glasgow) said that at the present time he was acquiring a laboratory where he hoped to make all his own tests in future. He had not tested the Selas system for himself; but he certainly would do so at the first opportunity, when his laboratory was completed. The system had been tested in Glasgow, and had given much satisfaction. He thanked Mr. Docking for his paper, but regretted that he might be one to strike a jarring note. He hoped, however, it would be a valuable one. Mr. Abady had dealt with the question of the on-cost brought about by volume; so he would not touch on this. What he deprecated was the comparison with other plants, which he thought, as gas managers, savoured rather of fouling their own nests. For instance, Mr. Docking's remarks, under the head of "Premises Cannot be Thrown into Darkness," he thought were not helpful to them as gas managers, because there was an undesirable innuendo there. He thought the members would gather his point from this. How often did the plunging of premises into darkness occur? They had had a little experience of high-pressure gas in Glasgow; and he did not know of any case of darkness prevailing

in the streets. He also joined issue with Mr. Docking on some of his observations under the heads of "More Uniform Light Through the Entire System," and "Maintenance Costs." If Mr. Docking claimed low maintenance costs, he thought it followed that he claimed less heat; and light and heat went together. If not, he was making out that Selas gas was a low explosive gas, and that other plants at the point where lighting-up occurred had such high explosive properties that maintenance costs ran up out of all proportion. Mr. Docking's contentions under this particular head therefore appeared to be rather far-fetched. Every system had its own value and its own useful points constituting its claim to recognition. Supposing he were using a plant at from 50 to 80 inches pressure, he had a scope to come and go on for differential purposes. He could not therefore use the Selas plant with the same range of facility as he might use other plant for public lighting purposes. He therefore thought it behoved the author of the paper to treat his opponents gently. He hoped that he would take these remarks in the spirit in which they were given. Now he would like to touch upon another point. In his statement of incandescent costs, he thought that Mr. Docking's figures were extremely fair; but he considered he had gone a little astray in attempting to make a point of the low heating properties of his gas when burning—*i.e.*, of the coolness of the atmosphere where his plant was being used. He would remind him of the experiments of Hehner and Rideal, proving that heat was one of the best means of ventilation. It was one of their strong points that heating was a good thing for ventilation. Mr. Docking, however, was trying to reduce heating to a minimum; and there again he joined issue with him. He did not think there were many other points upon which he wished to speak. He preferred really to give Mr. Docking's system a test; and he promised he would give it a fair one when he had his laboratory in working order. He thanked the author for his valuable figures. For his own part, he would be glad to submit to the members any figures he obtained in his future tests. Years ago he said at that Association that the catalogue was of enormous advantage to him.

Mr. DOCKING, in replying to the discussion, thanked the members for the kindly way in which the paper had been criticized. Mr. Abady had asked a question as to the capital cost. The capital cost of the plant for a small number of lights was larger than (say) that of the Keith or any other system. They could not make a Selas compressor as cheaply as an ordinary rotary fan, which was very easy to manufacture. Other makers usually dumped plant into the place that was required to be lighted up, and left it to the tender mercies of any local plumber. The Selas Company would not do this. One of their engineers accompanied every plant; and they had no plant installed that had not been fitted by their own men. In some cases their men spent a week or a fortnight on these jobs. This, of course, cost money; but they did not charge up the men's time—it all went into the cost of the compressor. They knew then that they had proper and efficient workmanship on the job; and if anything did happen to go wrong, they had their own men to blame. As regarded large plant, the Selas Company went about as cheap as the ordinary high-pressure gas people, because their lamps were less costly. They could not, of course, supply plant as cheaply on this side of the water as on the other side, where, with plants of over 300 lights, the prices compared very favourably with those of the high-pressure people. In further reply to Mr. Abady, as regarded the trial burners, they made them with three holes in place of one hole, to somewhat impede the velocity of the gas and get a more gentle flame, so that the height of the cone could be more easily determined. With all their lamps, with the exception of the silent one, they used single-hole nipples. The reason they preferred three holes with the silent lamp was to minimize the noise. On Mr. Abady's point as to belt-drive, in practically all cases in factories they used belt transmission from the ordinary shafting. It was seldom they had to put down a small engine—only in cases where it was required to work overtime at night, when the main engine was stopped. They preferred the simple motor subsidiary drive; but in nearly all cases the charges for current for this purpose were so prohibitive that they had to make use of a small steam or gas engine. They were beginning to know on this side of the water what they were doing on the other. In one particular case in Dublin, they charged 7d. per unit for the purpose.

Mr. LANGLANDS: Was not that a statutory company?

Mr. DOCKING: It is the Corporation.

Mr. ABADY: The maximum price is 8d.

Mr. DOCKING, continuing, said, with reference to candle power tests, all their tests were made horizontally with an ordinary small reflector, which did not make much difference one way or the other, as the rays of light were reflected downwards. Mr. Langlands did not seem to think he had dealt fairly with the compressed gas people when making the assertion that they required 2·4 cubic feet per 100-candle power yielded. They themselves had tested all kinds of high-pressure lamps, and they had not yet been able to obtain anything above 40 candles to the foot with any of the makes at 54 inches or any higher pressure with small-unit lamps. There was no high-pressure gas firm but their own who would give guarantees. Accompanying all their estimates there was a guarantee as to the gas consumed and the candle power yielded. In the case of the guarantee not being fulfilled, they undertook to take back the plant and accessories, and were entitled to no compensation whatever. They never refused anyone admittance to their photometers in Manchester; and he invited any of the members who might be in Manchester at any time to go along and take tests for themselves. A well-known member of the Association, not present, went down to London to a high-pressure lighting firm with the intention of taking some candle power tests; but he was refused—the excuse being made that the photometer was out of order. Theirs in Manchester was always open; and he maintained that there was no other firm but the Selas Company who had ever obtained an efficiency of 50 candles to the cubic foot of gas with small unit lamps. Mr. Abady had made some remarks about the automatic bye-pass. He might say they always advised the fixing of an automatic bye-pass, as it was practically impossible for it to fail to act—it being regulated to pass just a sufficient amount of gas to prevent the lamps from flaming when the town gas was brought into use. They did not say the automatic bye-pass would give sufficient light for work to be carried out in factories; but it would avert a panic in case the compressor stopped through engine failure or the belt breaking. Panic in a crowded building was a thing to be avoided. Recently they had fitted up a place in Dublin where there were some 2000 or 3000 girls working in the different rooms; and it would be a very serious thing if the place were to be plunged into darkness without any warning. He knew no machine was infallible, but no factory owner ought to allow a machine to be put into his place if it could not be guaranteed to give a light in case of a breakdown. With all due respect to Mr. Langlands' remarks, he held that if an automatic bye-pass was only wanted once in five years, on such an occasion it served its purpose. Mr. Tooms had asked what was the highest candle power lamp they made. The answer was 4500.

Mr. TOOMS: How many burners?

Mr. DOCKING: Three, of 1500-candle power each. Continuing, he said he now came to the question of heat. He knew heat was required. If there were a lot of people in a room, he would rather speak in a gas-lighted room than in one electrically lit. He found speaking much easier in a gas-lighted room, because the carbonic acid was carried away to the ceiling by the heat; whereas in a room lighted by electricity it all remained at breathing level. He was sorry he could not follow Mr. Langlands in his statement about low maintenance costs, which seemed to him (Mr. Docking) to be rather confusing. He could not form an analogy between maintenance costs and heat. What had heat to do with maintenance costs? They all knew that with an ordinary low-pressure burner the maintenance costs were much less than with high pressure; but the heat given off from a low-pressure burner, consuming (say) 4 cubic feet per hour, was double the amount given off a high-pressure burner which consumed practically 2 to 2½ cubic feet per hour. The reason of the excessive cost of maintenance in high-pressure lamps was very largely the velocity of the mixture at the point of ignition, and had but little to do with the explosive properties or heat evolved. With regard to the lighting of factories, in a great number of these cases there were already some machines which were creating an amount of heat, and in such cases the dropping of a few degrees in temperature was very much appreciated by the employees. Mr. Docking then read one or two letters from large factory owners in Belfast who had roughly 1000 lights in use, in which they stated emphatically that the change in temperature due to adopting the Selas light had afforded great physical advantage to the workers.

The PRESIDENT remarked that they had had a very valuable paper from Mr. Docking, and the Association could not appreciate too highly all that he had laid before them.

Carbon Deposits in Retorts.—We have received from the well-known firm of Messrs. Donald D. Macpherson and Co., of Manchester, particulars of a material which, they state, acts as a deterrent to a large degree to the formation of carbon deposits in retorts, and is especially recommended for use with vertical retorts. A finely-ground cement has been prepared, which is mixed with water to a creamy consistency, and can, without difficulty, be sprayed on the retort faces with an ordinary whitewashing machine. Its extraordinary glazing properties, it is claimed, achieve the purpose aimed at; and, being easy of application, it should prove very beneficial for use in gas-works.

Advantages of Rust in Painting Ironwork.—The following was one of the "Scientific Notes" in the "Ironmonger" recently: "A point of much practical interest is that brought out in the report of Dr. J. Newton Friend on 'The Preservation of Iron,' which is included in Vol. V. of the Carnegie Scholarship Memoirs of the Iron and Steel Institute. From the results of this research, it appears that a slight coating of rust, if perfectly dry and free from caking or lumps, is an advantage rather than otherwise in applying paint, though an ordinary thick coating of rust is, of course, objectionable. The thin coating permits a thinner paint to be used, as it is practically a pure ochre, and it also gives the paint a better grip. Dr. Friend obtained the remarkable result that his experimental plates suffered far less from corrosion when painted in a rusty condition than when first polished bright before painting. His paper concludes: 'It would seem, therefore, that when the painter is called upon to protect by painting thin sheets of iron, such as galvanized iron which has already rusted somewhat, any lumps of scale should be removed, and a coat of paint applied in warm, dry weather to the rusty surface. The danger of the sheets rusting through will thus be considerably less than if the rust is first carefully scraped off and the metallic surface polished with sandpaper before the application of paint, as is the more usual custom.'"

CONDITIONS AFFECTING EXPLOSIONS OF COAL GAS AND AIR.

By E. L. Sellars, M.Sc.

In the "Journal" last week (p. 438), we gave the first part of a memoir on the above-named subject submitted to the Manchester Section of the Society of Chemical Industry by Messrs. E. L. Sellars and C. Campbell, M.Sc. The portion then published was their united work; the second part, given below, was that of the first-named gentleman only.

I.—Effect of the Diameter of the Tube on the Rate of Explosion.

Three tubes, made of glass throughout, were used, 12 metres long, and of the following diameters: A, 44 mm.; B, 24 mm.; C, 12 mm. The distance of the sparking-wires from the end was 11 cm. The following diagram (fig. 4) illustrates the effect of the diameter of the tube on the progress of the explosion:

Diameters: Curve D, 12 mm.; curve D_1, 24 mm.: curve D^1, 44 mm.

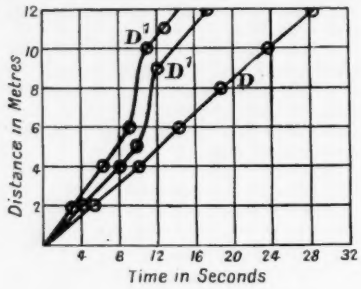


Fig. 4.

(1) *Sparking Near an Open End, the Farther End being Closed.*—A consideration of the curves indicated in fig. 4 shows that—(1) the velocity is increased with increase in diameter in the initial uniform period; (2) the period of maximum velocity can be eliminated by sufficiently diminishing the diameter of the tube; (3) in tubes where the period of maximum velocity can exist, the position of this period is slightly different in tubes of different diameter, but the duration of this period is not much affected.

A consideration of the following figures shows that the mean velocity during the period of maximum velocity is slighter greater in the 44 mm. tube than in the 24 mm. tube.

Mean Velocity, in Metres per Second, Measured during the Period of Maximum Velocity.

Experiment.	Diam. 24 mm.	Diam. 44 mm.
I.	0·82	0·97
II.	1·50	2·50
III.	0·88	0·96
IV.	1·82	1·89
V.	2·37	3·08
Average	1·47	1·89

In fig. 5, the effect of diameter on the time for the flame to travel 11 m. is shown. The time diminishes rapidly to a certain point with increasing diameter. With tubes less than 10 mm. in diameter, it was found experimentally that the flame goes out as soon as started.

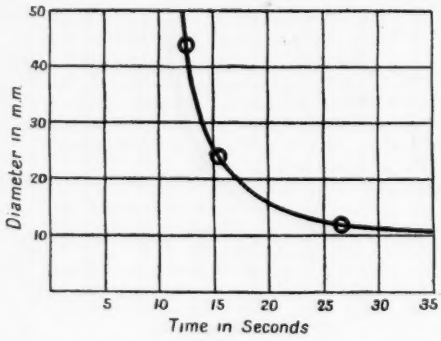


Fig. 5.

(2) *Sparking Near an Open End, the Farther End being Open.*—The tubes used were the same as in the case of the farther end closed. The flame starts with a steady flame until it has travelled about one-half the length of the tube. Oscillations of a small but increasing size then begin; being accompanied during the last metre of the propagation by some violence. In the 44 mm. tube, these latter vibrations are accompanied by a crackling noise; in the 24 mm. tube this noise is not so great; and in the 12 mm. tube there is no noise whatever.

As illustrated in fig. 6, the diameter of the tube affects very considerably the rate at which the flame travels; increase in diameter resulting in an increase in the rate. If, as in fig. 7, the abscissæ represent times for the flame to travel 9 m., and the ordinates represent the diameter of the tube, it will be seen that, above a certain limit, the diameter of the tube has little effect on the rate.

Diameters: Curve A, 12 mm.; curve B, 24 mm.; curve C, 44 mm.

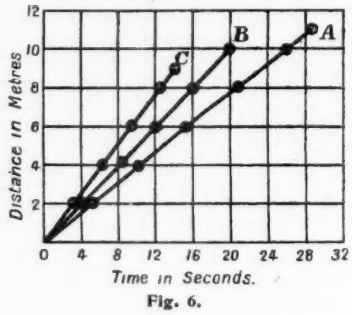


Fig. 6.

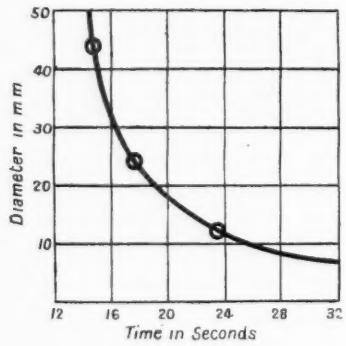


Fig. 7.

II.—Effect of the Length of the Tube on the Rate of Explosion.

The apparatus consisted of a glass tube 18 m. long, which was made up of shorter lengths joined together by rubber bands. This tube could be varied in length as required. The diameter throughout was 24 mm.

Comparative experiments were carried out under the following conditions:

(1) *Sparking Near an Open End, the Farther End being Closed.*—From a consideration of fig. 8, the effects of increasing the length of the tube on the progress of the flame are as follows:

(i.) *Effect on Initial Uniform Period.*—Increase in length of the tube has practically no effect on this portion of the progress of the flame. This does not contradict the results of the effect of length on the initial velocity [Part I.], since the results there obtained were from a careful study of the initial velocities every ¼ m., whereas in this portion the object is to observe the more

Lengths of Tubes.
Curve P, 6 in.; Q, 11·7 in.; R, 16·5 in.

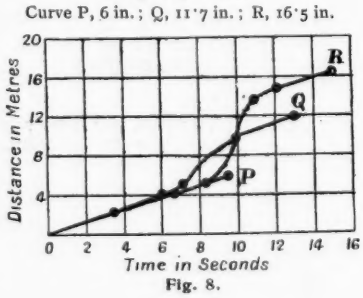


Fig. 8.

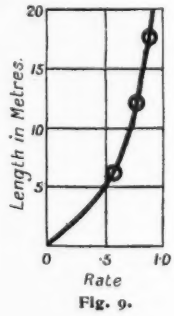


Fig. 9.

pronounced differences. The differences observed in Part I. are, as stated, very slight, and are not apparent unless the initial velocities are slow. It will be noticed from fig. 8 that in the case of a tube 6 m. long, the period of maximum velocity is not apparent.

(ii.) *Effect on Period of Maximum Velocity.*—The general conclusion to be drawn from a series of experiments is that (i.) the

period of maximum velocity is increased; (ii.) the average rate during this period is increased.

Effect of Length of Tube on Maximum Velocity.

Experiment.	Velocity in Metres per Second. Length 12 m.	Length 18 m.
I.	1·1	3·3
II.	1·6	2·1
III.	1·3	1·2
IV.	2·0	3·0
V.	1·2	1·4
Average	1·4	2·2

(iii.) *Effect on the Mean Velocity with which the Flame Travels from One End of the Tube to the Other.*—Plotting a curve with rates as abscissæ and length as ordinates a curve as in fig. 9 is obtained. This shows that increase in length of tube causes the mean rate to be increased to a certain limit, after which any further increase in length does not affect the rate.

(2) *Sparking Near an Open End, the Farther End being Open.*—Tubes of length 12 m. and 17·5 m. respectively, and both 24 mm. diameter, were used, and the gas mixture contained 12 per cent. of coal gas. In the shorter tube, the flame travelled steadily for about 4 m. Small oscillations then became apparent—these increasing in size as the flame progressed. In the longer tube, the flame behaved similarly; but a slight acceleration was observed between the sixth and the eighth metre.

The following table shows how the time increases as the flame progresses in the two tubes, being greater in the shorter than in the longer one.

Distance in Metres.	Time in Seconds. Tube 12 m. Long.	Tube 17·5 m. Long.
1.	3·4	3·2
2.	6·4	6·0
3.	9·2	8·7
4.	12·1	11·4
5.	15·0	14·5
6.	18·0	16·9
7.	21·3	18·7
8.	24·9	21·4
9.	27·1	24·2

Increase in length of the tube, therefore, causes an increase in the rate of the explosion under these conditions.

III.—Effect of the Distance of the Spark from the Closed End on the Rate the Flame Travels.

Sparking Near a Closed End, the Farther End being Open.

Apparatus.—The glass tube used was 4·4 m. long and 37 mm. diameter. At the sparking end, a brass piston was fitted, which could be moved close up to the sparking wires or any distance away up to 50 cm. The piston had a flush metal face, and was fitted with a leather bucket plunger, which was kept in position by a metal piece screwed on, and which would expand or contract with slight irregularities in the diameter of the tube, so as to be always gas-tight. The distances from the sparking wires were indicated by a scale fixed on to the tube.

When the explosive mixture was fired, the flame divided into a forward movement and a backward movement towards the piston. This work deals only with the flame travelling in the forward direction. Two fixed points were taken in timing the flame—(*a*) at the moment of firing, and (*b*) as the flame passed a mark on the tube. This mark was at least 1 m. away from the place where the flame went out.

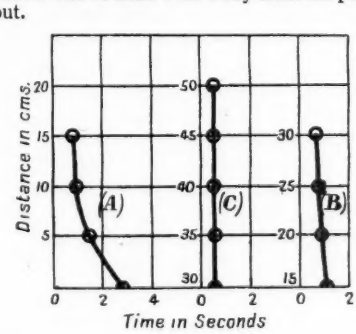


Fig. 10.

Observations were taken with the piston close up to the sparking wires with the piston 50 cm. away, and at every intervening 2·5 cm. Fig. 10 illustrates the results obtained in a tube 4·6 m. in length and 37 mm. diameter. The abscissæ represent the times taken by the flame to travel a fixed distance (2·5 m.); the ordinates represent the distances, in centimetres, of the piston from the sparking wires. The portion (A) shows the effect of moving the piston from a position close up to the sparking wires to one 15 cm. away. The increased velocity is very marked as the piston is withdrawn. The portion (B) shows the effect of moving the piston from a position 15 cm. from the sparking wires to one 30 cm. away. The increase in velocity apparent in (A) continues, though not so markedly, until the piston is 25 cm. away, when the velocity appears to be unchanged with any further withdrawal of the piston. With the piston at any distance between 30 and 50 cm. away from the sparking wires, the velocity is independent of the position of the piston, as shown in (C).

It is conceivable that the position of the piston may have a different effect on the velocity of the flame in tubes of different diameters; and this must be taken into consideration in studying the effect of the diameter of the tube under conditions of sparking near a closed end. Experiments were therefore carried out, with two other tubes of the following dimensions: (1) Length, 4·6 m. diameter, 44 mm. (2) Length, 4·6 m.; diameter, 24 mm.

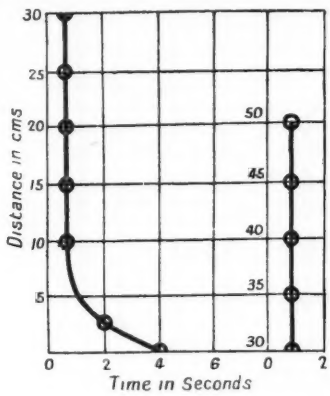


Fig. 11.

Figs. 10, 11, and 12 show the curves obtained from results of experiments carried out in the three tubes. The general form of each curve is the same; but while the effect of moving the piston from a position close up to the wires to a position 15 cm. away is very pronounced in the 44 mm. tube, it is not so apparent in the 37 mm. tube, and is scarcely perceptible in the 24 mm. tube. The positions of the piston which just give the maximum velocity differ, too, in the three tubes. In the 44 mm. and 37 mm. tubes, these positions are found to be 15 cm. and 25 cm. respectively from the sparking wires.

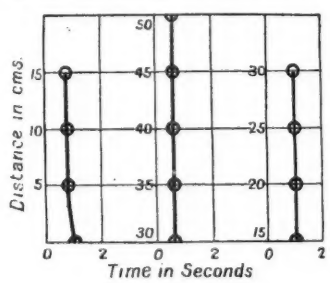


Fig. 12.

Conditions.—Sparking near a closed end of the tube, the farther end of which is open. Showing the effect of the distance of the closed end from the spark on the time taken by the flame in travelling 2·5 m. Diameter of tube = 24 mm.

Effect of the Material of the Tube on the Rate of Explosion.—Experiments were carried out in tubes of glass and of lead; each being 25 mm. in diameter and 12 m. in length. In the lead tube, short glass tubes (50 mm. long and 25 mm. wide) were interposed at every metre, to act as windows; the flame being timed as it passed each window. The flame in all cases was started by sparking near an open end of the tube, of which the farther end was closed. The gas mixture contained approximately 10 per cent. of coal gas.

The results point to the conclusion that the general character of the flame in the lead tube is the same as that in the glass tube —*i.e.*, the initial uniform period, the period of maximum velocity, and the final uniform period of the flame are apparent in both tubes. The average velocity, however, appears to be somewhat greater in the lead tube than in the glass one. The following are the results of various experiments, showing the time required for the flame to travel 10 m.

Experiment.	Time in Seconds. Lead Tube.	Glass Tube.
I.	8·3	9·3
II.	8·2	9·2
III.	5·5	6·7
IV.	5·1	7·2
Mean	6·8	8·1

Further investigation, however, in this portion of the subject is necessary.

Summary of Parts I. and II.

1.—The conditions of the tube in which the explosion takes place greatly affect the distance the flame travels.

2.—The state in which the ends of the tube are put—*i.e.*, whether open or closed—may change the whole character of an explosion. A flame started near an open end of a

tube may be quite feeble, and the velocity slow; but if the flame were started near the same end closed before ignition, the explosion might travel with considerable volume and velocity. This shows the possible effect of a closed passage on an explosion in a mine.

3.—The initial velocity of the flame started near an open end of a tube is increased by increasing the diameter of the tube. The length of the tube and the state of the farther end of the tube in some cases affect the initial velocity.

4.—Increase in length of the tube increases the rate of explosion up to a certain limit; increase in diameter also increases the rate up to a certain limit. In tubes less than a minimum diameter, the flame will not propagate itself.

5.—Sparking near an open end, the farther end being closed, the flame travels with a somewhat greater velocity in a lead tube than in a glass tube, although the general character of the flame is unaltered.

A GAS AND ELECTRIC AND BYE-PRODUCTS RECOVERY PLANT AT ACCRINGTON.

The last number of the "Electrical Review" contains, in an illustrated article, a record of some particulars of a very interesting municipal development at Accrington, where (in the words of our contemporary) the Electrical Engineer, Mr. Harold Gray, has "boldly left the beaten track and launched-out on a gas-engine scheme of some magnitude, and . . . is to be congratulated on his choice of plant."

The article continues: Speaking generally, the suitability or otherwise of gas-engine plant depends entirely on the working conditions which will have to be met. Under steady and continuous load conditions—such as exist in the case of the Accrington gas-engines—such plant, working in conjunction with producers and ammonia and tar-recovery plant, enables exceptionally low generating costs to be secured—the cost of fuel being either negligible or comparatively small.

The gas plant was supplied by the Power Gas Corporation, of Stockton-on-Tees. The producers, which are run on local bituminous coal, costing 13s. 6d. per ton, are of the Mond pressure type, provided with water bottoms, and fitted with wide fire-bars of the standard Mond pattern. Coal is delivered to a hopper below the road level, and lifted to the top of the bunkers by a bucket elevator, which delivers on to a distributing conveyor running over the bunkers. From the latter, the coal falls into 4½-cwt. measuring hoppers, which discharge into the producer bells.

The gas from each producer is led through a tubular superheater to a common collecting main. In passing through the superheaters, the hot gas raises the temperature of the steam and air supply to the producers to 225° C. The lower ends of the superheaters form dust-catchers, where the fine dust carried over with the gas is discharged at intervals.

From the collecting main, the gas, at a temperature of 400° C., passes through a washer, the interior of which is filled with fine water-spray produced by two revolving dashers; and the sooty matter deposited is removed through lutes at the side. The gas, reduced in temperature to 80° C., then passes through a spray arrester, fitted with baffles, to an ammonia absorber, also containing two revolving dashers which, in this instance, produce spray from a liquid consisting of a solution of ammonium sulphate with about 2 per cent. of free sulphuric acid. The acid in this solution combines with the ammonia in the gas to produce sulphate of ammonia. The process is continuous; and hence, as the liquor becomes augmented in strength, a certain portion is from time to time drawn off to a stock tank, and the remainder in the absorber is made up to the required volume with added water.

From the absorber, the gas passes through a second spray arrester and two vertical coolers (in which it meets cold water sprays and deposits the bulk of its tar) to a gas-governor consisting of a small sensitive gasholder, the rise and fall of which—depending on the rate at which gas is being used—controls the supply of pressure air to the producers through the medium of a butterfly valve, which allows more or less of this air to be discharged to the atmosphere.

The gas next passes through two centrifugal cleaners and a sawdust scrubber to the 18-inch gas-main running to the engine-house, prior to entering which, however, it is metered in a "Rotary" meter and passed through an anti-pulsator—another small gasholder similar to that already mentioned. The centrifugal cleaners, which run at 1400 revolutions per minute, perform a triple function, as, in addition to removing all but a trace of the remaining tar (the trace being removed in the scrubber), they also cool the gas further, and raise its pressure sufficiently to give a small reserve for working the anti-pulsator. The tar from the centrifugal cleaners, as also that from the coolers, passes out through water-sealed pipes to settling tanks, and is finally collected, steam heated in a boiler to get rid of any excess water, and sold at about 10s. per ton to neighbouring chemical works.

The air-blast for the producers is obtained from two No. 3 Roots blowers coupled to high-speed steam-engines. The air at 45 cm. water pressure is passed through an air-heating tower, where it meets jets of the hot water which has been returned from the first gas cooling tower, taking up a proportion of water vapour and being raised in temperature. A considerable quantity of steam is also introduced into the blast (roughly 2½ tons, which includes ¾ ton from the air-tower per ton of fuel gasified) prior to its being superheated to about 225° C. and entering the producers. The steam limits the temperature of the producer, preventing the formation of clinker and the destruction of the ammonia.

The blower-house also contains four small motor-driven centrifugal pumps, for circulating the water through the two gas-cooling towers, the water-cooling tower, which works in conjunction with them, and the air-heating tower. A gauge board is also provided here, containing nine water-gauges connected to various portions of the plant, the indications of which are logged at regular intervals, and show how the plant is working.

The ammonia liquor from the stock tank is lifted by means of an ejector to a feed tank in the sulphate-house, being drawn off and boiled in a vacuum evaporator until it begins to crystalize. The crystals are subsequently withdrawn and dried in a hydro-extractor; the product, known as grey sulphate, being sold for about £12 10s. per ton. At the present time, about 85 tons of coal per week is being gasified, and, as bye-products, 3¾ tons of sulphate and 10 tons of tar are obtained. The clean gas is delivered to the engines at 7 cm. water pressure and 25° C. temperature.

The gas plant is worked in conjunction with a fully-equipped chemical laboratory, where daily tests of the fuel, gas, and bye-products are carried out.

Turning to the engine-house, there are installed two 1000-B.H.P. gas-engines, direct-coupled to alternators and exciters. The engines are of the four-crank vertical enclosed pattern, each having eight cylinders arranged in tandem pairs—the lower ones 22 inches diameter, and the upper ones 23 inches diameter, to allow of the lower pistons being easily withdrawn. The air for the engines is drawn in through admitters in the engine-room, which are silent in action, and is mixed with the gas at the cylinder head. The exhaust from each engine is passed through a special locomotive-type boiler, which generates steam at about 100 lbs. pressure, for supplying the needs of the producer plant, and effectively silences the escaping gases. The cylinder cooling water from each engine is circulated through a Heenan cooler—an ingenious apparatus consisting practically of a large plate coiled in the form of a watch spring, which in revolving slowly abstracts the heat from the water, and is in turn cooled by means of air blown on to it.

The boilers and coolers are situated in the original boiler-house together with the anti-pulsator and three compressed air starting tanks for the gas-engines. A small motor-driven compressor charges up the starting tanks to a pressure of 300 lbs. per square inch.

The Accrington gas-engines have now been running about nine months, and supplying a very large proportion of the load on the station, which is rapidly growing during the day owing to the number of textile and machine works that have taken up electric driving. One of the engines runs throughout the 24 hours of the day; while the other runs during factory hours—*i.e.*, 6 a.m. to 5.30 p.m. Together, they generate about 120,000 units per week at the present time. The fuel consumption under these conditions is rather more than 1½ lbs. per unit, costing about 0·125d. Against this, there is to be credited from the sale of bye-products about 0·07d. per unit—leaving a fuel cost of some 0·05d. per unit generated. The gas-engine plant generates three-phase fifty-cycle current at 6000 to 6600 volts, and is linked-up to the older high-speed direct-current steam generating plant through three motor-generators—an arrangement which allows for the economical distribution of the load between the steam and gas plant.

Darlington Gas Undertaking.

We have received from the Gas Engineer and Manager of the Darlington Corporation (Mr. Frank P. Tarratt) the accounts of the Gas Department for the year ended the 31st of March last, prepared by the Borough Accountant (Mr. J. W. Armitage). They show that the gross profit was £14,682, and the net profit £8073—the latter being equivalent to 7·71d. in the pound, 4·32 per cent. on the capital invested, 4·94d. per 1000 cubic feet of gas made, and 5·34d. per 1000 cubic feet sold. A sum of £7000 has been transferred in aid of the general district rate, compared with £5750 before. The capital is £186,580, or at the rate of 10s. 3d. per 1000 cubic feet of gas sold, against 9s. 9d. before. A balance of £8073 is carried forward, against £8500. Under Mr. Tarratt's supervision, 38,045 tons of coal were carbonized, and 394,324,000 cubic feet of gas made, of which 362,896,000 cubic feet were sold; the gas unaccounted for being 6·64 per cent. There are altogether 14,338 consumers—7176 being of the ordinary and 7162 of the prepayment class. The figures for the preceding year were: Gas made, 411,962,000 cubic feet; sold, 379,445,302 cubic feet; unaccounted for, 6·45 per cent.; number of consumers, 14.183, of whom 7150 were of the ordinary and 7033 of the prepayment class.

Chester Gas Company.—At the ninetieth general meeting of this Company on Monday last week, the Directors reported that the balance to the credit of the profit and loss account, after providing for interest on the debenture stock and dividend on the preference stock, was £7064; and they recommended the declaration of an interim dividend on the ordinary stock, in respect of the half year ended June 30, at the rate of 2½ per cent. The Chairman (Mr. J. M. Frost), in moving the adoption of the report, said the receipts from the sale of gas showed a slight falling-off, which was solely owing to the reduction of 2d. per 1000 cubic feet in the price from the 1st of July last year. The receipts from residuals were satisfactory. The report was adopted, and the dividend recommended declared.

REGISTER OF PATENTS.

Compensating for Changes in Barometric Pressure in Pyrometers, Gas-Analyzing Apparatus, &c.

ARNDT, M., of Aachen, Germany.

No. 15,384; July 1, 1912. Convention date, June 30, 1911.

The object of this invention is to compensate for the effects of variations of atmospheric pressure upon the indications or the registration of the results of measuring operations in instruments and apparatus which carry out, periodically and automatically, measurements at pressures above the atmospheric.

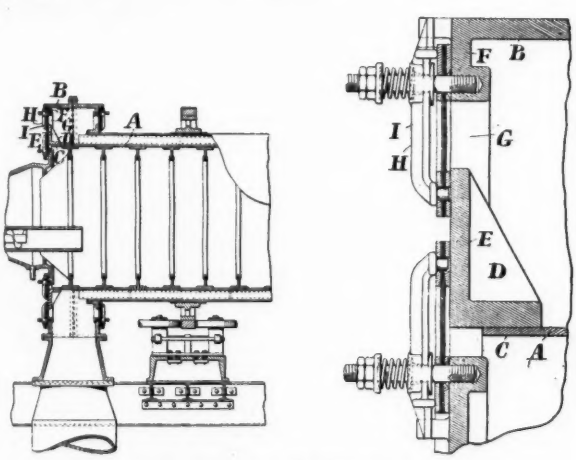
For this purpose, the indicating or registering apparatus is provided with a barometric compensating arrangement consisting in the suspended registering means or pen-carrier being released from its actuating mechanism during the measuring pauses, and resting in a bearing which is independent of the mechanism, but is displaced by means of a device actuated by the changes of atmospheric pressure in such a manner that the pen-actuating mechanism, before the commencement of a registering operation, on again contacting with the pen-carrier, carries it with it at various distances from the fulcrum of the operating lever under various barometric heights or (generally speaking) in a "barometrically reduced operative relation."

Flexible Joints for Connections between relatively Movable Parts.

ROYSTON, E. R.; a communication from the General Reduction, Gas, and Bye-Products Company, of New York City.

No. 17,032; July 22, 1912.

These joints are "adapted to make gas, water, or dust tight connections between parts which are movable relatively to each other," with particular reference to the type of joint wherein a flexible plate is secured to one part and is held in contact with the other part by spring pressure.



An American Flexible Joint.

The invention is shown as applied to one end of a rotary cylinder, with a fixed part B in the form of a head within which the end C of the cylinder revolves. Attached to this end of the cylinder is a ring D, having a vertical extending annular flange E. Upon the vertical surface F of the fixed part B, and adjacent to the opening G, is mounted the flexible joint H, preferably composed of a plurality of thin plates of sheet metal. The joint is shown in the form of an annulus, preferably with edges reinforced to provide rigid bearing parts attached to the surface F by bolts near the edge of the annular opening G, and part of which bears against the flange E. Upon each of the bolts is mounted a lever I, the point of which fits in a socket in the bearing. The spring mounted on each of the bolts is held under compression against the lever I by the nuts; while the point of the lever presses the bearing part against the movable part or flange E.

The bearing parts of the flexible joint H are thus always held firmly against the flange F by the levers and springs, and contraction or expansion or wear of parts does "not affect the efficiency of the joint, since its flexible middle section will permit its distortion to meet varying conditions."

Diaphragm Governors.

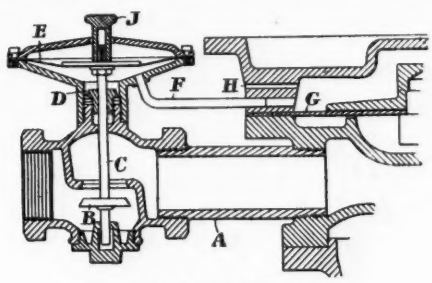
KEITH, J. & G., of Farringdon Avenue, E.C.

No. 25,643; Nov. 8, 1912.

This invention relates to an "emergency cut-off valve," applicable to diaphragm governors or reducing valves for regulating the flow of gas—more particularly as used in high-pressure gas distribution.

The use of such governors as at present employed has the drawback that in case of breakage of the diaphragm or blowing of the seal, it is possible for the full pressure which prevails on the inlet side to be transmitted to the outlet side of the governor. But according to the present invention, there is interposed in the inlet pipe a valve (connected to a diaphragm, piston, or the like) which is adapted to be closed by the rise of pressure on the low-pressure side of the diaphragm of the main governor.

As shown, there is interposed in the inlet pipe A a valve B, the spindle C of which passes through a gland D, and is connected to a diaphragm E (or to a piston or the like). The space between the gland and diaphragm is connected by a pipe F to the space on the low-pressure side of the diaphragm G of the main governor—a space which is enclosed, and provided with a small vent H. Alternatively, the space on the other side of the diaphragm E may be connected with that on the low-pressure side of the diaphragm G, in which case the position of the valve B in relation to its seat will be reversed.



Keith's Diaphragm Governor.

In the event of the breakage of the main diaphragm G, allowing more gas to pass through the break than can be taken off by the vent H, the consequent rise of pressure on the low-pressure side of the main diaphragm G will be communicated to the auxiliary diaphragm E, any movement of which acts to close the valve B, which is so disposed that when once closed the pressure of the entering gas tends to keep it closed against its seat.

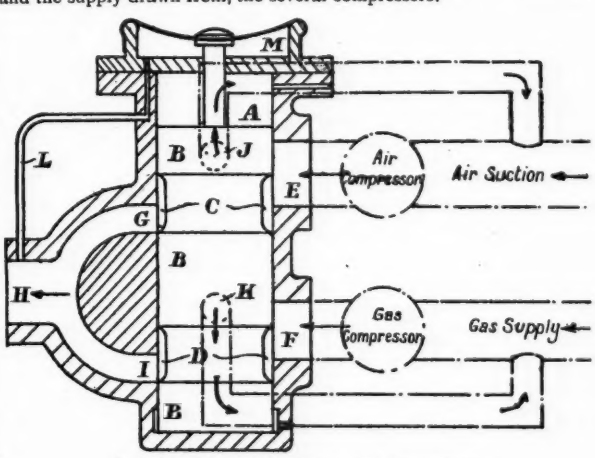
For re-opening the valve B manually, the valve spindle is provided with an extension J, protruding through the cover of the diaphragm E.

Producing Gas Mixtures.

OSTHOFF, W., of Barmen, Germany.

No. 19,841; Aug. 30, 1912.

This invention relates to apparatus for producing gas mixtures of uniform composition and constant working pressure from separately compressed fluids; and the feature of the invention resides in the fact that a single regulating member is used for controlling the pressure of, and the supply drawn from, the several compressors.



Osthoff's Gas and Air Mixer and Compressor.

The engraving represents a vertical section of a contrivance for the object in view, with the connections leading to the compressors.

The casing comprises a cylindrical box A, in which reciprocates a plunger or cylindrical valve B, formed with grooves C D. The casing has an orifice E for air supply and an orifice F for gas supply. G is a passage leading the air to the mixing-chamber H, and I is a similar passage for the gas. J is the return conduit to the air-compressor, and K is the return conduit to the gas-compressor. L is a passage for leading the pressure from the mixing-chamber H to the pressure-chamber M, covered with a flexible diaphragm connected by a spindle with the plunger valve B. The groove C serves to connect the air supply E with the passage G of the mixing-chamber and with the return conduit J to the air-compressor; and the channel D forms the connection between gas supply F and the return conduit K to the gas-compressor.

In operation, the whole volume of air produced by the air-compressor and the whole volume of gas delivered by the gas-compressor are forced into the mixing-chamber H, in which "an intimate mixture of gas and air takes place by reason of the strong current of the supplies."

The area of the channel G is exactly equal to that of the return passage J; and the same is also the case with the channels J and K.

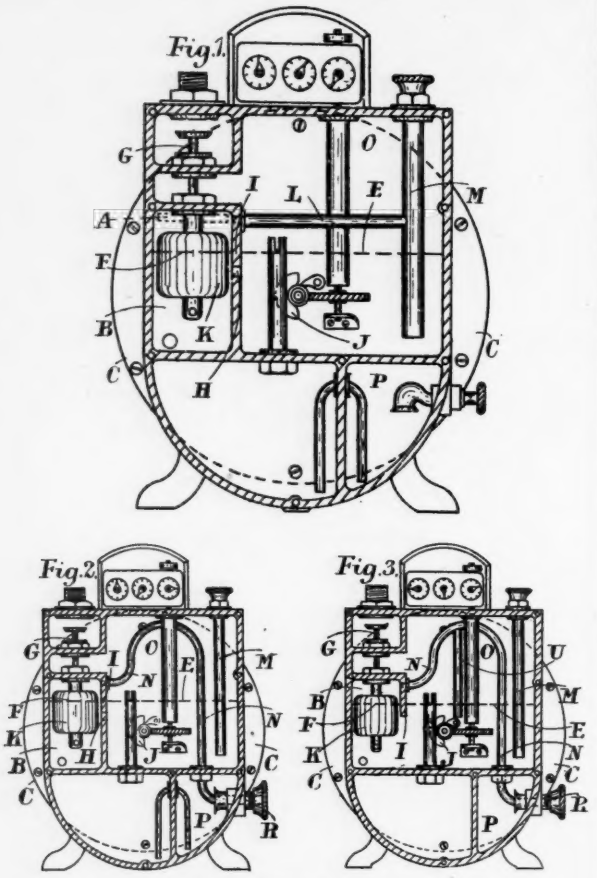
Should the delivered charge be larger than is required for consumption, the superfluous mixture flows through the pipe L into the chamber M, and forces the plunger valve B upwards, in consequence of which the channels G and I gradually close; while the return passages J and K open to an equal extent. Finally, when the consumption of mixture ceases entirely, the channels G and I will be fully closed; while the passages J and K will be fully open, so that the entire volumes of gas and air will be separately returned into the compressors.

Gas-Meters.

ATKINSON, A. H. & H. W., of Northcote, New Zealand.

No. 20,189; Sept. 4, 1912. Convention date, Sept. 29, 1911.

This invention relates to gas-meters of the enclosed float type—that is to say, meters in which there is no normal connection between the upper part of the float chamber and the gas space in the meter—and the special object of the invention is to prevent unregistered gas passing through the meter, "as occurs at present, when the meter is over-watered or the drum prevented from revolving."



Atkinson's Wet Gas-Meter.

Fig. 1 is a front elevation of the meter with the front plate removed and fitted with a vent pipe from the top of the float chamber to the water-filling tube. Fig. 2 shows an alternative form of vent pipe—curved upwards and downwards and leading through the waste chamber and discharge outlet at the bottom of the meter to the atmosphere. Fig. 3 shows a meter with the front plate removed—the vertical partition between the float chamber and the main chamber extending only part of the way down, and an extra vertical vent pipe joining the curved vent pipe at or near its highest point, and extending downwards till level, or nearly level, with the top of the opening, through which the spout passes to the drum.

In the ordinary form of "enclosed float meter," an opening A (shown dotted in fig. 1) is provided between the top of the float chamber B and the back or pot C of the meter; and it is found that, when the meter is over watered, the water line E, in the meter front O, is depressed without altering the water line F in the float chamber B, whereby the valve G is kept open, and gas passes through the meter without registering or revolving the drum in the pot of the meter. In this invention, however, the opening A is dispensed with altogether, and an opening H is provided in the partition I, level (or nearly so) with the top of the opening J, through which the spout passes to the drum, and which communicates with the pot C. Thus when the water line E in the meter front is depressed, it unseals the opening H and allows gas to enter the chamber B, and permits the water line F to assume the same level as in the meter front, which will have the effect of causing the float K to drop and close the valve G; thus shutting off the gas and putting the meter out of action. To release the pressure in the top of the valve chamber B, or prevent an air-lock taking place therein when the meter is being watered in the usual way, a vent pipe L is provided from the top of the chamber B to the water-filling tube M, which will communicate with the atmosphere when the pipe cap is removed.

In fig. 2, an alternative form of vent pipe N is shown, leading from the top of the float chamber B to the top of the main chamber or meter front, and curved downwards through the waste-chamber P at the bottom of the meter front, and out through the water-discharge outlet R. One cap screws over the outer end of the discharge outlet and closes both the discharge pipe itself and the end of the vent N, so as to prevent them communicating with each other when the meter is working.

In fig. 3, instead of having the opening H in the partition I, to enable the water lines E and F to equalize, the partition I is made to extend only part of the way down; the curved vent pipe N being shown with an extra vertical vent pipe U, joining the curved pipe N at or near its highest portion, and extending downwards till level, or nearly level, with the top of the opening J, through which the spout passes.

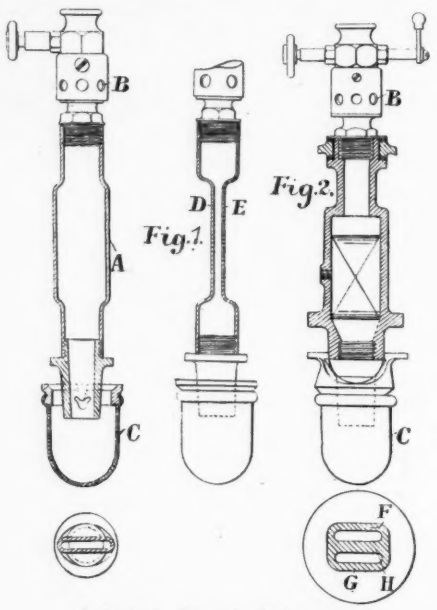
With the exception of dispensing with the opening A, introducing the opening H, or forming the partition I, as illustrated in fig. 3, and employing any of the means described for relieving the pressure or preventing an air-lock in the float chamber B, the meter is constructed, as usual, with the gas inlet and outlet, water inlet, and other necessary parts, "with the result that the meter so constructed can be relied on to be put out of action on any attempt being made to over water it."

Gas-Burners.

ANDERSON, D., of Farringdon Road, E.C.

No. 29,457; Dec. 21, 1912. No. 3540; Feb. 11, 1913.

This invention has for its object to prevent back-firing on ignition and extinction of gas-burners, by "flattening a portion of the tube leading to the burner so that the two walls of the tube approach closely towards each other for a suitable distance along the length of the tube."



Anderson's Atmospheric Burners.

Fig. 1 shows (partly in section) a single-burner lamp having a flattened tube in the pipe leading to the burner. Fig. 2 is an elevation (partly in section) of a lamp having a flattened tube with a partition in the passage leading to the burner.

In fig. 1, as applied to an inverted incandescent burner, the pipe A leading from the gas-nipple and the air inlets B to the mantle C is constructed so that at one part the walls D E approach one another for a short distance along the pipe. For instance, if a pipe of $\frac{3}{8}$ inch internal diameter is used, a satisfactory result may be obtained by merely bringing the walls of the pipe towards each other, forming a flat space $\frac{1}{8}$ inch across. The portion of the tube which is thus deformed may be of any suitable length, and for a single inverted burner satisfactory results are said to be produced if the deformed part of the tube is made about $1\frac{1}{2}$ to 2 inches long. The end of the flattened portion is shaped to give a free flow of gas through the flattened portion.

In the form shown in fig. 2, a casting, formed with flat sides F G and a partition H between them, is inserted between the gas-nipple and the air inlets B and the mantle C, and a similar result is said to be obtained with this arrangement. The partition is parallel with the direction of flow in the pipe, and "gives a considerably increased surface of metal with the thin layer of mixture between the metal surfaces."

Hydro-Pneumatic Gas-Controller for Water-Heaters.

MILON, P., of Saint Mandé, France.

No. 4504; Feb. 21, 1913. Convention date, Feb. 26, 1912.

This hydro-pneumatic apparatus is for the purpose of "effecting without valve or other mechanism the uniform and simultaneous distribution of a liquid and a gas to the utilization vessel." It is applicable for supplying water-heaters for baths or other apparatus of the same kind, and works automatically "in a manner absolutely regular and sure."

The apparatus is a combination of a water aspirator connected to the liquid supply pipe and to the consuming apparatus (and operating whenever the supply is used), with a gas receptacle also supplying the consuming apparatus, and having an inlet pipe connected to the gas supply system and an outlet pipe to the consuming apparatus. It contains liquid (preferably mercury) in such quantity that the flow of water or actuating liquid of the aspirator produces "automatically, progressively, and without jerks," the opening or closing of the outlet pipe supplying gas to the consuming apparatus through the variations of level of the mercury in the receptacle, substantially as described.

PARLIAMENTARY INTELLIGENCE.

CLOSE OF THE SESSION.

Bills Royal Assented.

The session closed last Friday, when the following Bills received the Royal Assent by Commission :

Aberystwyth Corporation Bill, Airdrie Corporation Gas Order Confirmation Bill.
Barry Urban District Council Bill, Blyth and Cowpen Gas Bill, Bournemouth Gas and Water Bill, Bradford Corporation Bill, Broadstairs and St. Peter's Urban District Council Bill.
Coventry Corporation Bill.
Derby Corporation Bill, Dunfermline Corporation Water Order Confirmation Bill, Dunfermline District Water Order Confirmation Bill.
Ebbw Vale Water Bill.
Gas Orders Confirmation Bill, Gas and Water Orders Confirmation Bill (No. 1), Gas and Water Provisional Orders Bill (No. 2), Grays and Tilbury Gas Bill.
Heathfield and District Water Bill, Huddersfield Corporation Bill.
Kirkcaldy and Dysart Water Order Confirmation Bill.
Lanarkshire (Middle Ward District) Water Order Confirmation Bill, Leeds Corporation Bill, Leicester Corporation Bill, Liverpool Corporation Bill, Llantrisant Gas Bill, Local Government Provisional Orders Bill (No. 6) [Portrush Electric Lighting Order], London County Council (General Powers) Bill, Lymm Urban District Council Bill.
Metropolitan Water Board Bill, Mid Kent and East Kent District Water Bill, Morley Corporation Bill.
Pontypridd and Rhondda Joint Water Board Bill.
Redcar, Coatham, Marske, and Saltburn Gas Bill, Rochford Rural District Council Bill.
Silloth Gas Bill, Swanage Urban District Water Bill.
Titchfield District Gas Bill, Tottenham and Edmonton Gas Bill, Tynemouth Gas Bill.
United District Gas Bill.
West Bromwich Corporation Bill, West Hampshire Water Bill, Westgate and Birchington Gas and Electricity Bill, Worthing Gas Bill.
York Corporation Bill.

KINGSTOWN ELECTRIC LIGHTING ORDER.

Further proceedings in the matter of the above-named Order took place last week. It may be remembered that the Electric Lighting Provisional Orders Bill (No. 6), from which the Order had been removed, was referred back to the Committee who had considered it, for the reinstatement of the Order and the division of the Bill into two Bills. This was done ; and the report of the Committee came before the House on Tuesday, and was read. It was to the effect that No. 6 Bill contained the Portrush Order only, and that the Kingstown Order had been made No. 8 Bill. The first-named Bill was then reported without further amendment, and was ordered to be considered next day. It came up accordingly, was read the third time and passed. With regard to the other Bill, it was ordered to be suspended, so that it might be proceeded with next session. It will be introduced, and pass through the preliminary stages *pro formâ*, and stand referred to the Committee of Selection. Any petitions presented against the Kingstown Order this session will also stand referred to the Committee. It was further ordered that a message should be sent to the Lords to acquaint them with the decision come to. Their Lordships had the matter before them on Thursday, and resolved to inform the Commons that they had concurred with them in suspending the Bill.

HOME OFFICE INSPECTION OF PAINTERS' CRADLES.

The West Ham Gas-Works Accident.

In the House of Commons last Tuesday, the subject of the necessity of inspection by the Home Office authorities of cradles used by painters was brought forward.

Mr. W. THORNE, in accordance with the notice he had given, asked the Home Secretary whether his attention had been called to three men being killed at the West Ham Gas-Works on Friday, the 1st inst., in consequence of the painting-cradle falling through a rotten rope being used ; if he was aware the Coroner stated that he hoped the Factory Inspectors who were present at the inquest would recommend a better system of testing the ropes ; and if he was prepared to grant powers to local authorities to enable the local Inspectors to examine ropes attached to all such painting-cradles, and to inspect the chains attached to Scotch derricks and cranes.

Mr. ELLIS GRIFFITH (the Parliamentary Under-Secretary) said his right hon. friend had received a report on the circumstances of the accident and the proceedings at the inquest. The Coroner appeared to have said that it was within the province of the Inspectors to recommend the making of regulations for bringing about a better system of testing ropes. But the painting of buildings was not, as such, within the Factory Act ; and further powers must be given by legislation if the Home Office was to deal with the matter. The provisions of the Buildings Bill, which was in draft, would enable regulations to be made as to the precautions to be observed in connection with cradle-ropes ; and the matter would be considered when the Bill passed. He should point out, however, that the Building Accidents Committee had this point before them, but did not recommend the testing of ropes in use ; and it was doubtful whether any system of testing which might be likely to accentuate a latent defect would be desirable.

Mr. THORNE asked the hon. gentleman if he was aware that hundreds of the cradles in question were in use in connection with gasholders, schools, and so forth.

Mr. ELLIS GRIFFITH said he tried to explain that legislation was required before the Home Office Inspectors could have control over this class of work.

Mr. THORNE asked whether it was intended to introduce legislation next session to deal with the subject.

Mr. ELLIS GRIFFITH replied that he could not pledge the Government on such a matter.

Mr. THORNE said he would remind him of it next session.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of the Company was held last Wednesday, at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Mr. CHARLES CARPENTER, D.Sc., M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. F. M'Leod) having read the advertisement convening the meeting and the minutes of the last ordinary general meeting, the seal of the Company was affixed to the "Register of Proprietors."

THE CHAIRMAN'S SPEECH.

The CHAIRMAN : Ladies and Gentlemen,—I assume that it is your desire to take as read the report and accounts which have been presented to you, and I will now formally move their adoption.

THE HALF-YEAR'S RESULTS.

I must preface the remarks I have to make by expressing the great satisfaction felt by my colleagues and myself in being able to present to you a statement of accounts in which income has rather more (though by a very little) than balanced expenditure. The last two years have been very anxious ones ; and we have on more than one occasion during that period discussed the question of raising the price of gas. I need not say we have strained every nerve to avoid such a misfortune as that would be, not only to ourselves but to our consumers and our workpeople ; and in our efforts we have been aided by that buoyancy in our business, which is not perhaps so remarkable when it is remembered that our chief commodity is gas. Thanks to this feature of elasticity which the hard knocks we have experienced at the hands of the coal-producing industry have not altogether destroyed, we have managed, as the report tells you, to make both ends meet, paying practically the same dividend as you have been receiving, with a short exception, since 1904.

IMPROVED METHODS OF WORKING.

Someone may ask : "But have you made no advances or improvements in your methods or processes during that period ?" Certainly we have. We have greatly strengthened our position by getting into touch with customers' requirements. But we have done much more. We have put into our undertaking a great amount of brains, intelligent endeavour, and hearty good-will ; and if we were having our deserts, consumers would be paying less for gas, the employees would be credited with a larger bonus, and you would be receiving a higher dividend as a result of great improvements in manufacture which, largely upon our initiation, have been widely adopted by others as well as ourselves. But the fruits of our labours have been practically swallowed up by the voracious appetite of the coal industry. How long this will go on it is impossible to determine. But there are signs, I am pleased to say, that it is slackening ; and it is to be hoped that the owners of coal deposits will soon be satisfied with a fair and liberal proportion of the profits arising therefrom, instead of the lion's share. The serious fact remains, however, that we are giving a higher price for coal than it fetched after the great strike ; and the increase in the bill is being largely met by the consumers, the greater number being slot-meter users buying their gas in pennyworths.

THE COAL QUESTION—NEED OF AN EXPORT TAX.

The law of supply and demand is, I am aware, the arbiter of price in the case of coal ; but it certainly broke down in the case of gas, with the result that all gas undertakings were put under legislative control in respect of the amount of profit they may appropriate from carrying on their business. It is also, to my mind, at least doubtful whether the unrestricted export of coal is in the nation's best interests. It must be borne in mind, in conjunction with this, that what is called the remarkable prosperity of the coal trade is most particularly in regard to those fields which have a large export trade. Demand for inland fuel is not nearly so brisk, probably because of the high prices which our own manufacturers cannot afford to pay. Increasing quantities of fuel are going abroad to meet the requirements of foreign manufacturers of iron and steel—not in the form of foundry coke, which would increase the production in Great Britain of spirit for motor traction and heavy oils for the Navy's requirements, but as the raw material—coal—from which these valuable bye-products are prepared by our competitors. An export tax on coal, and the free export of metallurgical and other coke, would undoubtedly help British manufacturers, and increase the employment at home of British labour in the oil-producing industry. Having regard to the large requirements of motor spirit both for our commerce and for defence, and the increasing importance for the Navy of oil as fuel, it is surely important to keep as much as possible of the production in our own country.

INCREASED GAS CONSUMPTION.

The rise in gas consumption is not unsatisfactory when it is remembered that it is upon a substantial increase on the corresponding half year of 1912. The increase then represented the entire sales of gas in

towns of the magnitude of Maidstone or Margate. The present increase is equivalent to another such as Guildford—a result with which we may feel satisfied.

DETAILS OF WORKING—THE NEW PURIFYING PROCESS.

As regards working details, there is not much change to report. But a satisfactory reduction has been effected in works costs. Thus, in spite of an increase in the quantity of gas made, the manufacturing charges are somewhat less; while a substantial improvement in the cost of repairs, amounting to £17,600, has been effected. Purifying charges are also lower by some £8000; while at the same time gas of greater purity has been supplied. In connection with purification, I am glad to be able to report that the sulphur-reduction apparatus erected at the Old Kent Road works has continued to work with a minimum of trouble and with full realization of the expectation formed with regard to it. Coal, generally speaking, contains, as now delivered to us, more sulphur than was at one time the case; and we shall have greater independence in the market when we can buy without reference to this impurity, consequent upon the fact that it is easily and readily removed when we come to purify the gas. No matter, then, how sulphurous the coal, we have been able to produce gas having a degree of purity hitherto unattained, and this too without any nuisance or difficulty. The new plant we are erecting at our East Greenwich works will have the advantage of its cost being reduced by one-half, while the running cost, which is mainly for fuel, will be considerably reduced by economies which seem obvious when we look at the present apparatus.

DISTRIBUTION CHARGES.

The only other item in the accounts to which I need refer is distribution charges. In this department we have had to bear the burden (there have been great concomitant advantages) inseparable from pioneering. We were very early in the field with slot-meters, for instance, and large numbers of the earlier makes were not only expensive but complicated compared with the design of those being fixed to-day. We are gradually bringing up all to a uniform standard; and we shall reap the future advantage of reduced cost of upkeep. The same is also true of gas stoves and fires, with regard to which we have been adopting a similar policy. The total distribution charges are better by some £6000 than in the half year under comparison.

A PUBLIC LIGHTING CONTRACT AND HIGH-PRESSURE LIGHTING FOR THE TOWER BRIDGE.

It is satisfactory to record the fact that the use of gas is extending, not only for private and manufacturing purposes, but for street lighting also. We have lately obtained, in competition, a contract with one of the large municipal authorities for lighting with improved lamps and burners; and high-pressure lighting, which is so popular in all busy shopping thoroughfares, will soon be applied to the Tower Bridge.

VALUE OF THE COMPANY'S STOCK.

I think, perhaps, I ought to say a word or two with regard to the market value of our stock, which, as you all know, has appreciably fallen lately. This fall has been common to other gas undertakings, and, taken by itself, might indicate a lessening of faith by the public in the security of their holdings. But upon comparing the drop with that experienced in the case of gilt-edged securities generally, I think it will be found that any cause for anxiety disappears. We last raised capital by the issue of ordinary stock in 1907; and if we take our position to-day and compare it with the corresponding date of that year, the reduction is 8·2 per cent. So I think we have every reason to be satisfied. The attention of investors has been lately directed to the subject of wasting assets, and their influence upon the stability of certain industrial concerns. I need not remind you that our assets are not wasting ones. All our plant, apparatus, mains, and services are well maintained, and our business of gas supply was never more firmly established, for it is on a broader, and I may say ever-widening, basis.

EFFECT OF CO-PARTNERSHIP ON THE EMPLOYEES.

Before I sit down, I want to trespass a little longer on your patience while I say a word or two about our relationship with our employees. The London County Council employs for its tramway services a similar number of employees to our own, and largely, though not wholly, in South London. A little while ago, attention was directed in the Press to some figures, furnished upon the authority of the Chairman of the Tramways Committee of the Council, in regard to the great increase in absence, due to sickness, which had manifested itself among the employees since the passing of the National Insurance Act. Indeed, cries of "increased sickness" and "malingering" seem to be issuing from all quarters of the English industrial world. I have had similar figures taken out with regard to our own men, and I am pleased to find nothing has been disclosed comparing with the London County Council figures, or indeed of any abnormal nature. I will not draw comparisons; but I think I am entitled to say this on behalf of our employees: The spirit of co-partnership has inspired them with what is right and what is wrong, what is just and what is unfair; and they have brought these feelings into play in dealing with an Act, the complex provisions of which are only equalled by the amount of red-tape encountered in the endeavour to comply with them

THE COMPANY'S FIRST-AID CORPS.

What is true of sickness is equally true with regard to accidents. The percentage of incapacity due to accidents has been practically unchanged for the last three or four years. In this respect, we enjoy the great advantage derived from the presence at all our works of a large number of men (some hundreds in all) trained by our doctors and instructors, and under the general auspices of the St. John Ambulance Association, to give first aid in the case of accident or sickness. One man in every ten holds a certificate, qualifying him to render first aid. If any accident does unfortunately arise, there is almost sure to be somewhere near a man who is qualified to give first aid in respect of the mishap. A large percentage of the men are also members of the St. John Ambulance Brigade, which provides skilled first aid, not only for the public upon important occasions, but for defence purposes also; and their efficiency is very highly esteemed by those best fitted to judge. I mention these facts because the relationship of our employees with us does not become less important as time goes on; and there is no doubt we are to-day reaping enormous advantages from the system, the full value of which can only come about as a question of time.

REPORT AND ACCOUNTS ADOPTED.

I, formally, move: "That the report and accounts now presented be received and adopted, and the report entered on the minutes." In the temporary, but unavoidable, absence of the Deputy-Chairman, I will ask Mr. Kenneth P. Hawksley to second the resolution.

Mr. KENNETH P. HAWKSLEY: Ladies and gentlemen, I have much pleasure in seconding the resolution which has been placed before you by the Chairman. He has so carefully gone through every point of our interesting history during the last six months, that I think I cannot with advantage detain you any longer.

The CHAIRMAN said the resolution was now open for discussion, and he should be pleased to hear any remarks the proprietors desired to make.

No observations being offered, the resolution was formally put to the meeting and carried unanimously.

THE DIVIDEND.

The CHAIRMAN: I have to move: "That a dividend at the rate of £5 9s. 4d. per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post." I do not know that I need, in moving this, to add any remarks to those I have already dwelt upon in proposing the first resolution; and I will ask Mr. W. H. Cupit, one of the Employee-Directors, to be good enough to second it.

Mr. W. H. CUPIT expressed his pleasure in seconding the resolution, which was carried unanimously.

The CHAIRMAN: That, ladies and gentlemen, concludes the business for which you have been called together this afternoon.

VOTES OF THANKS.

Mr. GEORGE HOWLETT said he thought the proprietors would not like to separate without according a very hearty vote of thanks to the Chairman, Directors, and officers, for the ability with which they had carried on the affairs of the Company during the past half year. Six months ago some shareholders were anxious as to what was going to happen in the future; but all had come out right, as he had said it would. He was not, as a rule, a prophet, nor the son of one. But he then felt there was "life in the old dog yet;" and it had been so proved up to the hilt. They had come safely through a time of exceptional difficulty, and had avoided raising the price of gas. He was perfectly certain these were troublous times for directors of gas companies. He was, however, convinced that the proprietors, at any rate, had nothing to fear, but everything to congratulate themselves upon, in the extraordinary success of the South Metropolitan Gas Company. He moved a hearty vote of thanks to the Chairman and Board, for their conduct of the business during the past six months.

Mr. CROOKENDEN said he had much pleasure in seconding the motion. He was sure the Board had been through troublesome times during the last twelve months. He had some knowledge of the coal trade; and regarded the increase in the price of coal with a good deal of misgiving. Although he was interested both ways, he should like to see some sort of a tax put upon the export of coal. Every penny per 1000 cubic feet on their consumption meant about £30,000 in six months; so that if they had to raise the price of gas, the proprietors would not lose much, but the greater loss would be spread over the consumers. His point was that the margin was at present very small; and the Board naturally wished to build-up the insurance fund, from which they had to take a large sum two or three years ago. Obviously, this could only be done from a substantial surplus of income over dividend.

The motion having been carried unanimously,

The CHAIRMAN said: For myself and my colleagues, I beg to express our high opinion of, I think I must say, your too flattering words. All I can say is that we do our best for the Company with which we are all associated. It is quite true, as both speakers have stated, that the times through which we have been passing have been extremely troublesome; and the disturbing factor has been the export of coal. During the last seven months, ending with July, the quantity of coal exported was 10 million tons greater than in the previous year. The last year was a little complicated by reason of the coal strike; but the figure is 6 million tons over and above the year before that. So you will readily understand what a disturbing factor this introduces among those who have to carry on industries in England, whether gas or other manufacturing ones. I should like to take this opportunity of giving you the exact figures with regard to the cost of gas. One penny per 1000 cubic feet increase in the price means about £56,000 a year, or, as Mr. Crookenden said, approaching £30,000 for the half year. It is true we have it in mind to again build-up the insurance fund as soon as possible. We had unfortunately to draw heavily upon it by reason of the great coal strike. The present tax upon the industry by the high price of coal is so great as to make it almost impossible to contemplate its long continuance. Whether we shall, in the near future, get it reduced, one cannot say; but one cannot imagine that coal is going to indefinitely remain at its present figure. When it comes down, as I think it is bound to do, we shall be in a position to build-up our reserves in the case of the insurance fund, upon which we had to trench last year. I thank you very much for your kind vote.

THE OFFICERS AND THE STAFF.

I will ask your indulgence for a few moments in order to move a vote of thanks to the officers of the Company, because I need not point out that no one knows better than I do how we must rely upon our chief officers for carrying on an undertaking of this kind. It is all very well to pass compliments to the Chairman and the Board; but it is on the officers and the staff that the prosperity of the Company depends. We have a most admirable staff, both engineering and commercial; and, in proposing a vote of thanks to them all, I should like to associate the names of Mr. Gibb, our Chief Engineer, than whom there is no more loyal and devoted officer, and Mr. M'Leod, our Secre-

tary, who is equally anxious in every endeavour to promote the welfare of the Company.

Mr. W. EDGAR seconded the motion; and it was carried unanimously.

Mr. W. DOIG GIBB (the Chief Engineer), on behalf of the technical staff and workmen, thanked the Chairman for moving, and the proprietors for passing, the vote of thanks. He said he had only a short and monotonous tale to tell, as he told many times before—namely, that the staff and workmen continued to pull together, and to do their work efficiently, earnestly, and harmoniously. Without these conditions, it would not have been possible to produce the balance-sheet they had now had submitted. Under ordinary circumstances, what he had said would have sufficed; but, as the Chairman had been very careful to dissociate himself from the engineering staff, he (Mr. Gibb) desired to say that the Chairman occupied a dual position—he was Chairman of the Company, but he was also an eminent engineer as well, and his assistance encouraged every one of the technical staff to do his duty well and faithfully.

Mr. F. M'LEOD (the Secretary) thanked the Chairman for his kind reference to the sections of the staff with which he was associated. The technical staff did well, and the commercial and clerical staff did their best to follow the good lead given them, encouraged by the knowledge that they had the confidence of the Board, and were greatly assisted and stimulated by the votes so kindly passed at these meetings. On behalf of them all, he thanked the proprietors very much for their kind expression of approval.

The proceedings then terminated.

CROYDON GAS COMPANY.

The Half-Yearly Meeting of the Company was held on Friday last, at the Offices, Katharine Street, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. W. Topley) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

RETIREMENT OF MR. HELPS.

The CHAIRMAN, in moving the adoption of the report and accounts, first referred to the retirement of the Engineer and General Manager (Mr. James W. Helps). He said:

I cannot enter upon the subject of our half-year's working without first saying how keenly your Directors share the regret with which, I am sure, all our stockholders will have noticed that the name of Mr. J. W. Helps no longer appears as that of the Company's Chief Officer. The circumstances which have necessitated his retirement we all deplore. Nor is the loss of his active services ours alone. For a generation, he has been in the forefront of every movement tending to the advancement and welfare of our industry. Not in England only has he been known as an able and tireless worker in its ranks. If, as I am sure is the case, he quits active life reluctantly, it is with the knowledge that few, if any, men have done more than he for its benefit. We trust that comparative leisure may bring him restored health, and enable him with enjoyment to engage in the many fields of activity in which he has rendered, and it is to be hoped may yet render, such good service to his fellows. You may see in the adjoining office a photograph, taken on June 25 at our works, when all, or practically all, our employees to the number of over 600 met, and some of the Directors who could be present, to show the esteem in which Mr. Helps is held among them. His retirement has rendered necessary fresh arrangements for carrying on the Company's business; and you will, I am sure, agree that the promotion of his Chief Assistants in the manufacturing and distributing departments (Mr. Caddick and Mr. Sandeman) has been well deserved by their excellent work in the past in your service.

INCREASED BUSINESS AND WORK IN THE DISTRIBUTION DEPARTMENT.

Proceeding, the Chairman said the accounts again testified to the steady growth and solid prosperity which had characterized the working of the Company for many years. This was so whether they looked at the increase in the sales of gas—over 5 per cent., or nearly 40 million cubic feet for the half year—at the increased number of consumers (1051), or at the additional number of stoves in use (2148). This last increase became more striking if they took a period of (say) the last five years, during which the results of the energetic work carried out by the distribution department had been especially marked. If they adopted for comparison the half year ending June, 1908, they had an increase in the number of stoves on hire of 15,281—from 20,384 to 35,665, or 75 per cent. in five years; while if they included the stoves sold to consumers, they got an additional number of 2890, or a total increase of 18,171. A good start had also been made in the promising field of use of gas for water heating. This application of gas, while it contained one of the greatest possibilities of future progress, also afforded to consumers the most complete advantage of the use of gas, since by its means the convenience of ever-ready hot water was added to that of ever-ready cooking and house warming. It had been found necessary to make further provision for the needs of the distribution work in the rapidly growing northern part of the district; and the Directors had thought it wise to secure facilities for displaying to residents there the appliances now available for the varied uses of gas. They had accordingly purchased a property with a good frontage to London Road and St. Helen's Road, Norbury. Plans had been prepared for the erection there of an adequate show-room and district offices, to which he thought they might look for assistance in developing the business in that district. Those present would have noticed the progress made towards the enlargement of the Company's central offices. Before the next half-yearly meeting, he hoped the work would be finished, and the new building be in use. This would give the Company and the town a great improvement in the immediate surroundings of the present offices, and while making ample provision for immediate needs would also allow a greatly improved display of gas appliances. It would be realized that the expenditure incurred in this direction indicated a robust faith on the part of the Directors in the future growth and prosperity of the industry generally, and in that of their own Company in particular. Those most intimately acquainted with the progress of the industry in recent years, and with the developments now taking place, would, he was sure, be the first to agree that such a faith was well founded.

THE NATIONAL GAS EXHIBITION.

The autumn was to see opened—in the month of October—at the "White City," Shepherd's Bush, a National Gas Exhibition, which they were justified in believing would do much to convince the public, or such as needed convincing, how useful, and indeed necessary, a thing gas is, not only in domestic life, but in many departments of industrial activity. The exhibition was planned on a scale never before attempted—at all events, in this country. But its chief feature would be that it was a co-operative exhibition, created and supported by the joint action of gas undertakings and makers of gas apparatus and appliances. The bewildering variety of competitive exhibits—all alike in their general characteristics—which was a feature, and to the visitor not an entirely pleasing one, of most exhibitions of the kind, would be absent. In its place would be carefully planned exhibits, each showing, in an intelligible and convincing way, some use of gas, while trained attendants would demonstrate the capabilities of the various apparatus displayed. The exhibition would be well worth seeing; and he hoped many of the stockholders would visit it and induce their friends to do likewise. They were distributing among their consumers cards of invitation; and the Secretary would gladly send some to any proprietor who might intimate a wish to receive them and to see the exhibition.

A RIFLE RANGE.

It might interest some of the proprietors to know that there had been constructed at the works, as an addition to the many facilities there for the employees' recreation, a rifle range, which is, he believed for its size, as well arranged and equipped as any in the district. Some sixty of their men were members of the Territorial Force, and were granted facilities annually for the necessary training. To these, and to others who desired to acquire a knowledge of the rifle and marksmanship, the range would, the Directors hoped, be found useful and acceptable. The officials would, he knew, very gladly arrange to show, by appointment, to any of the stockholders, what had been done in this and other directions, towards providing means of recreation for the Company's employees.

A NEW GASHOLDER.

The Directors had found it necessary, consequent upon the steady growth of the business, to take steps for increasing the gasholder capacity. It was now some nineteen years since the last holder—containing 3 million cubic feet—was erected at Waddon. Since that time, the gas sales had increased more than threefold; and now the holder room available was not more than 60 per cent. of what might easily be a maximum day's output in the coming winter. The new holder would have a capacity of 6½ million cubic feet; and though the outlay would be a large one, it could not with safety be further postponed. When completed, the holder would facilitate the manufacturing operations for some years to come. He might say that at the Board meeting that day, the Directors had settled the contract for the construction of the tank.

THE FINANCIAL RESULTS.

Turning to the financial results of the half-year's working, it would be seen that a comparison with the figures of last year was rendered somewhat difficult by reason of the fact that, owing to the coal strike in the early part of 1912, manufacture was then carried on under somewhat abnormal conditions. As a consequence, a comparison showed a large increase this year in the quantity of coal carbonized, and a proportionately increased yield from residuals. Coal had also cost more per ton; the extra expenditure due to price representing for the half year about £2400. Unfortunately, they were faced in the year now commenced with a yet greater burden in this direction; and the extra cost under this head would be a heavier one, while the indications did not warrant the expectation of a corresponding gain from the sale of residuals. They all hoped, and it was generally thought, that the present abnormal price of coals could not be maintained, and that before the contracts were made in May or June next, the price would be much lower. Broadly speaking, the increased expenditure last half year on coal and oil (£11,000) had to be set against the increased receipts from the sale of gas (£5000), rental of meters, stoves, and fittings (£800), and residuals (£7400). This left a net gain of £2200, which is slightly exceeded by the general increase in expenditure incidental to the growth of the business, with the result that the gross profit was less by £3700 than in 1912. Of the profit available, after providing for dividends, £3000 had been applied towards further writing-down the old Caterham works, leaving them with an increase of £1300 to add to the carry-forward, which would then stand at £25,728, which was more than would be required for the next half-year's dividend. This was a result which he thought would compare favourably with the working of most other gas companies, and should commend the report and accounts to the favourable consideration of the proprietors.

The DEPUTY-CHAIRMAN (Mr. T. Rigby) seconded the motion.

Mr. C. WEBB asked for information as to the make of gas per ton of coal carbonized, and as to the probable cost of the new gasholder.

The CHAIRMAN stated that the make of gas varied somewhat—the average for the past half year being 12,710 cubic feet per ton. The cost of the holder it was estimated would be from £50,000 to £60,000. For this, they would have to raise fresh capital.

A STOCK EXCHANGE QUOTATION.

Dr. CRITCHLEY suggested to the Directors that they should consider the question of obtaining a Stock Exchange quotation. There was hardly an industrial concern of the magnitude of this one that had not a quotation on the Stock Exchange. At the present time, if anybody wished to sell any stock, the method to be pursued was antiquated, cumbersome, and very costly. There was on the Exchange a "Gas

Market;" and he certainly thought it would be an advantage to the proprietors if the stocks were quoted.

The CHAIRMAN said they had a quotation at one time; but the transactions were so small, that the stocks were struck out of the list. He should think that nine-tenths of the transfers, such as they were, were made in Croydon. He thought the fact that stocks were held so tightly that they were removed from the lists through the fewness of the transactions, was rather satisfactory.

Mr. WEBB (Messrs. F. A. Helps and Sons) supported the proposition of Dr. Critchley. He thought that the time when the Company's stocks were quoted was many years ago; and the concern was not then so big as now.

The CHAIRMAN remarked that it was possible that before many years the Company might be going to Parliament again, and then their stock might be converted into one capital. That would be the time to again approach the Stock Exchange.

Mr. WEBB, however, could not see why they need wait any indefinite time for a quotation.

Mr. C. E. BOTLEY remarked that in the case of a company with which he was connected, they had found a Stock Exchange quotation was a positive disadvantage to the proprietors. The price quoted bore no analogy to the proper value of the stocks; and if a proprietor wanted to sell, such quotations were misleading. He knew of other companies whose experiences had been the same.

Mr. WEBB asked whether the Board had any objection to a quotation. There were several gas companies quoted who had only a few and even one transaction in the course of a year.

The CHAIRMAN said the Secretary reminded him that the "A" and "B" stocks were still retained by the Stock Exchange; but they were not printed in the list because so few transactions were recorded.

The subject then dropped; and the motion for the adoption of the report was unanimously carried.

THE DIVIDEND AND OTHER BUSINESS.

Mr. WILLIAM CASH moved the declaration of dividends at the following rates per annum: On the "A" stock, 15 per cent.; on the "B" and "C" stocks, 12 per cent.; on the "D" stock, 5 per cent.; and on the "E" stock, 10 per cent—all less income-tax. He remarked that from the accounts it would be seen that they had during the half year earned the dividend; and, after writing-off the sums alluded to by the Chairman, they added £1300 to the carry-forward. This resolution had been moved on many occasions by Sir Corbet Woodall. But he asked him to say on this occasion that he regretted he was unable to remain for the meeting. He had, however, been attending a meeting of the Board, and they had had the advantage of his valuable advice in their deliberations. Alluding to the question of a Stock Exchange quotation, he stated that there was comparatively a free market in the stocks in Croydon; and the Secretary could always tell the proprietors the price at which the stocks were changing hands, and what was approximately a reasonable and fair price.

The motion was adopted.

Mr. C. E. BOTLEY moved a vote of thanks to the Chairman and Directors. The report and accounts, he observed, showed the great efficiency which the Company had achieved through its administration. He was glad to hear that the Company were going to have a new show-room at Norbury, because he believed show-rooms of the kind were a great incentive to increased consumption.

The motion, having been seconded, was heartily passed.

The CHAIRMAN responded on behalf of his colleagues and himself. In doing so, he said he also regretted that Sir Corbet Woodall was not able to be at the meeting. But his health was not of the best; and he could not stand too much exertion. He had been up from Wales for the purpose of attending the Board meeting; and they had had the advantage of his advice, which his fellow Directors all very much appreciated.

A VOTE FOR MR. HELPS.

Mr. WEBB thought the proprietors would like to express their sympathy with Mr. J. W. Helps upon the cause of his retirement. The name of Helps was familiar to him; seeing that it was a Mr. Helps who fifty years ago took him (Mr. Webb) under his wing, and now he was trading under the name of Helps. He was sure the proprietors would like to express their sympathy with their late Engineer and General Manager.

Mr. R. HESKETH JONES said he wished to second the motion, because he had long known Mr. Helps, and he knew intimately of the active part he had taken in the affairs of the Company and of the gas industry generally.

The CHAIRMAN said he was glad this resolution had been proposed. The Directors received the intimation of the suggested retirement with much regret. But they felt that the health of Mr. Helps would not permit him to carry on his duties as he would wish to do, being a conscientious man. It was with the greatest regret indeed that the Board felt they ought to accept his resignation. Another thing in which the proprietors would feel the Directors had done right was in appointing Mr. Caddick as Engineer and Works Manager. Practically for two years Mr. Caddick had carried on the work and had managed the Company successfully; and therefore the Board were only too pleased to acknowledge his services, not only during those years but during the many he had been with the Company, and to appoint him to the position. The Chairman proceeded to move a vote of thanks to the officers, staff, and workmen for their efficient services. He specially mentioned the work of Mr. Topley, Mr. Caddick, and Mr. Sandeman. They were loyal, and so were their staffs and the workmen.

Mr. SAMUEL SPENCER seconded the motion, which was cordially passed.

Mr. TOPLEY, having replied to the vote on behalf of his staff and himself, said that it had been a matter of great regret to the officers that the changes that had been made in the management of the Company had been brought about by the ill-health of their old chief. None of those present could feel more keenly than the officers who had been privileged to serve under Mr. Helps all they had lost during the half year.

Mr. CADDICK, replying for the engineering and works staff and men, said he could conscientiously say that no company could possess a more loyal body of men, nor men who took a greater interest in the affairs of the company. He specially thanked the Chairman for his kind remarks concerning himself, and the proprietors for the hearty manner in which they had received the announcement of his higher appointment. He also desired to associate himself with Mr. Topley's remarks concerning the retirement of Mr. Helps.

Mr. SANDEMANN also acknowledged the vote for himself and the distribution and sales department. He had an able staff, who were all doing their best for the Company.

THE NEW CHIEF ASSISTANT TO THE ENGINEER.

The CHAIRMAN remarked that, in consequence of the promotion of Mr. Caddick, the Directors had to fill the position that had hitherto been held by him under Mr. Helps. The Board had had five candidates before them that day; and they had appointed Mr. Helps's eldest son—Mr. Reginald A. Helps. They had selected him as assistant to Mr. Caddick not because he was Mr. Helps's eldest son, but because he had shown, by his training and testimonials, that he was the right man to fill the position that had become vacant through Mr. Caddick's promotion. At the same time, taking all things into consideration, he (the Chairman) was sure it would be the wish of, and give pleasure to, the proprietors to see the name of Helps continued in official association with the Company. [Hear, hear.]

BOURNEMOUTH GAS AND WATER COMPANY.

The Christchurch Gas and Wimborne Water Acquisition.

The Ordinary General Meeting of the Company was held last Friday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. CRISPE WHITELEY in the chair.

The SECRETARY (Mr. H. A. Plumb, F.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

THE NEW ACT.

The CHAIRMAN, in moving the adoption of the report and accounts, said the past half year had been one of considerable activity, not entirely without interest to the Company. They had been in Parliament during the whole of the time; and it was merely a question of moments now as to whether they were out of it yet. They were hoping, however, that the Bill would receive the Royal Assent before the meeting ended; and the Bill would then become an Act. He knew that some of his able and distinguished colleagues, who were experts in their various professions, almost revelled in the atmosphere of the Committee rooms, and some of them were never so happy as when they were in the witness chair. But he (the Chairman) was apt to look at the matter from the point of view of the litigant; and, to change the metaphor somewhat, when they dissected the clauses and cut off this provision and that provision, he could not help sympathizing with the patient when he eventually successfully got out of the operating-room. In carrying on negotiations over the Bill, as they had been doing very vigorously, they had followed the traditions (as he hoped they always would do in that Company) of agreeing, and being on the highest and fullest terms of amity, with all those with whom they had to work. In discussing matters with the municipal authorities—and when in Parliament they had to discuss matters with a great many people—the Directors had endeavoured to meet their wishes and desires in every possible shape, never forgetting that while the Company were asking for public privileges, they knew that, attaching to them, must be public duties. The Directors had agreed with their friends quickly while in the way with them. They had tried to do all the authorities wanted them to do, and had never given them a firm and positive negative, unless they were quite sure it was in the interests of the Company they should do so. The Board had done as much by negotiations out of the Committee rooms as they possibly could, and as little of it in the Committee rooms as they possibly could. He always thought that negotiation round the table was much more satisfactory, and certainly it was very much cheaper. Therefore, he could congratulate the proprietors on the way the Bill had gone through. They had undoubtedly got an Act of Parliament which would be of value to the Company. He was interested to see in a Bournemouth paper the other day that there were one or two of the councillors who thought the last drop of blood had not been squeezed out of the Company. He could reassure their Bournemouth friends that they really had yielded all that they intended to yield; and if they had gone on, and had fought the Company in the Committee rooms, they might have spent a great deal more money, and possibly might have got less than they did obtain in the circumstances.

THE RESULTS.

What were the results? They had taken over on the one side the Wimborne water undertaking, and on the other side the Christchurch gas undertaking. The advantage to the Company of obtaining the Wimborne water entirely in their own hands was that they would avoid possible complications in the future, and that the water supply of the Downs, which comprised the watershed of the River Allen, were now in the hands of one controlling authority—a matter which was of considerable importance. To the Wimborne consumers, the Company would offer a better, softer, and in due course cheaper, water. To the Bournemouth consumers, they would be giving a larger supply of Wimborne water, and would be inviting them to share the Wimborne rights which applied to that district. On all hands, therefore, there could be no doubt as to the wisdom of having obtained possession of the Wimborne water. With regard to the other side of the question—that of gas. At the other end of their district, they had been so accustomed, and had got used to, very large developments—developments by leaps and bounds; but it was quite clear to them now that they were, so far as the old district was concerned, at the end of these striking developments. If they were to offer to their successors anything like the same opportunities as they had had themselves, they must look for fresh fields and pastures new. In the Bill, which he hoped was by this time an Act, the Company had taken over a very large and important district with 8 miles of sea front—looking over to

the Isle of Wight on one side, and extending inland to the beautiful country surrounding the New Forest. By so doing, they had acquired the Christchurch Gas Company, or were about to acquire it, at a time when it was of modest and small dimensions. Therefore, they were able, in taking it over under the just and reasonable provisions of their Act, to do so at a time when it had not grown to any formidable size. "All's well that ends well." He was sure they would be strengthened by the new Act; and the strengthening of the Company, as he had said from the chair before, must be not only to the benefit of the Company, but to all those with whom the Company was brought into contact, and to all those for whom its work was carried on.

A SUCCESSFUL HALF YEAR.

While all this work had been going on, they had been fortunate in having a successful half-year's working. He was not going into the details either of the accounts or of the working, because he intended to ask Sir Corbet Woodall to second the resolution, and to draw attention to the very excellent points that were attached to the report. Sir Corbet had been very much before the world during the past year. It had been a very eventful year for him; and they all congratulated him very heartily upon the honours that had most worthily been bestowed upon him. They were proud to have him as one of their colleagues to assist in carrying on the work of the Company. Therefore, he should leave in Sir Corbet's hands the question of the working, merely saying what he might not be able to say quite so strongly as he (the Chairman) desired to do—that the accounts reflected the highest possible credit on their Chief Engineer and General Manager. It was really one of the best half year's of Mr. Harold Woodall's professional life, and one of the most active; and it had made them all indebted to him to a very large extent—not only for carrying the Bill through Parliament, and for carrying on locally the negotiations with the municipal authorities, but for the successful working of what had now become a very large concern. They congratulated him very heartily upon the way it had all been done.

CAPITAL AND ITS ISSUE.

Then there was not only the existing work, but the work that was coming upon the Company under the new Act. They would want more capital; and he should like to say a few words under that head, because this was not a very good time to get money for various reasons—for no reasons connected with the Company or its work. The very strength of their financial position was to a certain extent against them. Financiers who supplied funds and raised capital liked something a little more lively and exciting than the Bournemouth Gas and Water Company. The Company was too solid, sound, and secure for the average financier to make much fuss over, or to take much trouble about getting money for it. Under these circumstances, he did feel that he could appeal to the shareholders very strongly to assist the Directors. The Directors had used the money well in the past; and he was sure the proprietors had every reason to be satisfied with the way it had been expended. They could appeal, too, to the way they had worked in the past, in asking the proprietors to give them fresh sinews of war to carry on an extended business in the future. The Board were going shortly to issue some debenture stock. This stock was of a fine gilt-edged character. At the present time the money required to pay interest on the debenture stock was £5000 a year. If the Board raised the proposed debenture stock, there would be a further £1833 to be paid—making £6833 in all. The net water revenue alone was about £23,000; so that the interest would be covered three-and-a-half times. In other words, although the debentures would be a first charge upon both gas and water, they could throw over, for this purpose, their gas business entirely, and still three-and-a-half times cover the interest by their net water revenue. As a friend of his had said to him, it was difficult to conceive a sounder security.

COAL AND OIL.

He was tempted to say something about the price of coal and oil. The chairmen of most gas companies were doing this at the present time; and certainly it was a very serious matter. There were no signs of the fall of prices so far as oil was concerned. It seemed to be going up and getting worse and worse. He did not like to prophesy; and he knew nothing about the matter of the future of coal prices at the present time. But he noticed that the Governor of the Gaslight and Coke Company ventured upon a very guarded prophecy with regard to it. He was speaking from a higher rostrum than he (the Chairman) occupied, and was speaking from an experience he (the Chairman) could not hope to emulate. And he gave some hope that the industry was getting very near to the end of the high prices. Whether this was merely a wish that was father to the thought, or whether Sir Corbet had some special grounds for saying what he did, he could not say; but he hoped the prophecy would come true. The prices were, from the point of view of the Directors, unjustifiable; and there must be an end or a turning-point to the worst state of affairs. There were several points in the accounts he should have liked to have touched upon; but he must not take up time in doing so. But there was one item he might give as an instance of the points of interest in the accounts. The sale of fittings had nearly doubled, which showed that gas was still very popular for domestic and other purposes.

CO-PARTNERSHIP.

The co-partnership scheme, too, was a great success. It had now been established five years; and they had placed to the benefit of the scheme nearly £12,000 from their funds. The majority of their employees were proprietors; and the gratifying thing about it all was that it was not only the money that had been handed over, but the general good-feeling which resulted from all getting together at the annual meeting. He wished the proprietors could see the heartiness and the tone of their annual meetings, when he had the pleasure of speaking to 500 of the Company's employees in their own assembly hall. It was certainly very remarkable. He did not wish to enter into controversial matters; but he must say that it did seem to him, so far as undertakings like gas companies were concerned, that they were on the road to solving some—he would not say all—of the difficult problems connected with capital and labour which were troubling the industrial world so seriously. He began his speech by saying the past had been a strenuous and somewhat busy half year. The man who perhaps had had to bear, in proportion, more of the brunt of this strenuousness than any other, had been their Secretary, Mr. Plumb. Never had he worked better and harder than in the correspondence and conferences connected with the Bill. He had had to conduct most important negotiations when the Board were not present; and he had acquitted himself well. This being so, he (the Chairman) would like to say how fully they appreciated the work he had given to the Company during the half year, and to congratulate him upon it.

SOME STRIKING COMPARISONS.

Sir CORBET WOODALL, in seconding the motion, remarked that the Chairman had referred to the joy with which some men occupied the witness chair before Parliamentary Committees. He did not know about the joy, but in the interest he afforded to his listeners probably no one was more successful than their colleague Mr. William Cash. When the Chairman asked him (Sir Corbet) to say a few words upon the progress of the Company, it occurred to him that one item Mr. Cash mentioned before a recent Committee which showed the juvenility of their Company, might interest the proprietors. He stated that twenty years ago, the quantity of gas sent out by the Company was 188 million cubic feet, and last year it had grown to 880 millions; so that in twenty years it had grown nearly five times. In the same period, the water revenue had gone up from £18,000 to £44,000. A matter that was also of supreme importance to their own as to other companies of the kind was the relation of the capital expended to the amount of business done. Mr. Plumb had been kind enough to get out for him that morning these figures: Ten years ago, the capital expended was £555,747; last year it was £806,379. This was an increase of £250,631, or equal to 45 per cent. In the same time, the quantity of gas sold had risen from 413 million to 880 million cubic feet—an increase of 467 millions, or 113 per cent. The 45 per cent. increase of capital had therefore provided 113 per cent. of gas for sale. Regarding receipts, and taking percentages, the gas receipts in the ten years had increased by 72 per cent., and the water receipts by 60 per cent.; while the balance of revenue account had grown by 61 per cent. He (Sir Corbet) thought these records were extremely satisfactory from the point of view of capital. Coming to the work of the year, it was quite clear they were not falling away from the high standard of working of those past periods to which he had referred. There had been hardly any difference in the quantity of coal used in the current half year compared with the corresponding half of 1912; but they had increased their sale of gas by 28 million cubic feet—28 million cubic feet increase in sales, without any increase in the quantity of coal carbonized! The make per ton of coal was greater by 850 cubic feet. The coke sold was 10¼ cwt. to the ton of coal, against slightly less than 9 cwt. in the corresponding period of last year. The same quantity of tar had been sold; and there had been a great increase in the quantity of sulphate of ammonia. The Chairman had referred to the fittings sold. To him (Sir Corbet) it was extremely encouraging to know that in 1911 they sold £2126 worth of gas-fittings; in 1912, £2973; and in 1913, £4580. The increased business done, while it varied very much as to the quantity of gas sold through ordinary and prepayment meters, averaged 8 per cent. over the whole for two years. All these figures showed not only a growing business, but a business growing on extremely sound and stable lines. It was not for him to say anything in endorsement of what the Chairman had said regarding the management; it would hardly come well from him. But this he could say, that the General Manager must look with great satisfaction upon a statement such as the one they had before them. [Hear, hear.]

The motion was unanimously carried.

The CHAIRMAN proposed the declaration of dividends, all less income-tax, at the following rates per annum: On the preference shares, 6 per cent.; on the "B" ordinary shares, 7 per cent.; and on the original shares, 15 per cent.

Mr. CHARLES L. MORGAN, M.Inst.C.E., in seconding, said he should like to take this opportunity of thanking the proprietors for endorsing the resolution put by the Directors at the last half-yearly meeting, which made it possible for him to occupy a seat at the Board. Since then he had taken the opportunity at Easter of going down to Bournemouth, and inspecting the district and the works. There he met Mr. Cash, who was kind enough to sacrifice three days of a short holiday in showing him not only the Company's present district, but the district which it was intended to annex under the powers of the new Act. He also had the advantage of going over the works with their Engineer and General Manager. He was afraid he was then a little bit tiresome, because he wanted to know a good deal; and he wished to take this opportunity of acknowledging with gratitude that Mr. Woodall gave him on his visit much information that was out of the ordinary routine. He not only went over the gas-works, but over the pumping-stations. He had also been down to Bournemouth on the ordinary visits of the Board. The result was that he was impressed very favourably indeed with the whole district for both gas and water supply, and especially so with the extended district. He was particularly struck with the excellent location of the gas-works from the point of view of the transmission of materials. They had water carriage, and excellent arrangements for conveying coal and other materials into and from the works. So far as his judgment went, the works were thoroughly up to date. He went through the offices and show-rooms; and he could not do better than say, after the American mode, that they had a really live concern. The whole business, from the officers downwards, was absolutely alive with interest, and an intelligent interest. They were to be congratulated on the possession of such officers as Mr. Woodall, and the staff under him. In his opinion, they were all thoroughly capable of performing their duties in the best possible manner. Mr. Plumb, too, was not, as was so often the case, merely a recording angel, but he had an exceptional knowledge on financial and other matters appertaining to gas and water undertakings.

The proposition was unanimously agreed to.

On the motion of the CHAIRMAN, seconded by Mr. WILLIAM CASH, a resolution was approved authorizing the Directors, in virtue of the powers conferred upon the Company by section 38 of the Company's

new Act, to raise the sum of £45,833 debenture stock, ranking *pari passu* with the existing debenture stock, and carrying such fixed and perpetual preferential interest not exceeding the rate of 4 per cent. per annum as the Directors might, on behalf of the Company, attach thereto prior to the issue thereof. [At the time the resolution was approved, the Bill had not received the Royal Assent; but a quorum remained until it had been given, and then formally passed the resolution, in order to be technically exact.]

Moved by Mr. GLEN, and seconded by Mr. J. C. BENWELL, a hearty vote of thanks was passed to the Chairman and Directors.

The CHAIRMAN, having responded, moved a hearty vote of thanks to Mr. Harold Woodall and Mr. Plumb, their staffs, and the workmen at Bournemouth. In the course of his remarks. the Chairman acknowledged the zealous work of all.

The motion was cordially adopted.

Mr. WOODALL, in his reply, spoke in the highest terms of praise of his staff, and of the efficiency of the workmen; while Mr. PLUMB, in the course of his acknowledgment, said that he must share the kindly remarks that had been made concerning himself with one of the members of the Board—Mr. Cash—as he always had the opportunity of talking matters over with him; and so he knew perhaps better than anyone else that Mr. Cash deserved to share the commendation given to him (Mr. Woodall).

SOUTHPORT CORPORATION GAS UNDERTAKING.

Working in the Past Year.

The Gas Engineer and Manager of the Southport Corporation (Mr. John Bond) has issued his report on the working of the Gas Estate for the year ended the 31st of March last. It furnishes the following particulars.

The sale of gas increased by 24,277,000 cubic feet, which is 4·62 per cent. above last year's figures; and sales of residuals produced £3104 more. The prepayment system of gas supply now amounts to 14·03 per cent. of the whole consumption, and shows an increase of 12·49 per cent. Of the total gas supplied through ordinary meters, the Southport consumption was 338,935,300 cubic feet, or 79·78 per cent.; Birkdale, 72,850,100 cubic feet, or 17·15 per cent.; Ainsdale, 10,741,600 cubic feet, or 2·53 per cent.; and the remaining 2,287,500 cubic feet, or 0·54 per cent., was consumed in the Banks and Scarisbrick districts. The average price received for all gas supplied was 2s. 6·36d. per 1000 cubic feet. The total capital expended per 1000 cubic feet of gas sold was 11s. 2d., or 3d. less than in 1911-12. The capital outstanding was 6s. 11d., against 7s. 3d.

The gross profit was £31,390; and the net profit, £16,557. After paying £13,000 to the borough fund, there remains a balance of £3557. The Gas Committee resolved to pay £5000 towards the reconstruction account, by taking £3500 from the year's profit and £1500 from the reserve fund.

The gas-making material used last year was: Coal 48,005 tons, an increase of 3475 tons; oil, 514½ tons, a decrease of 147½ tons; coke, 1344 tons, a decrease of 481 tons. The maximum and minimum makes of gas during 24 hours were 2,341,000 and 992,000 cubic feet. The work in connection with the vertical retorts and telpher installation is progressing satisfactorily; and Mr. Bond contemplates having the plant ready for work by the 30th prox. During the year the Gas Estate was kept in a thorough condition of efficiency; and Mr. Bond is confident the saving by the modern installations now being erected will to a great extent counterbalance the increased cost of coal.

The total quantity of gas made and sold in the past financial year was:

	Cubic Feet.	Cubic Feet.
Made	—	571,873,000
Sold to private consumers	501,962,900	
Do. for private and public lamps	47,295,200	
Used in works and offices	4,544,000	
Supplied free	721,000	
		554,523,100
Unaccounted for		17,349,900 or 3·03 p. ct.

The number of prepayment meters in use last year was 5736, an increase of 353; and the quantity of gas consumed through them, 77,148,200 cubic feet, or 8,571,400 cubic feet more than before. The number of ordinary cookers in use on March 31 was: On simple hire, 3131; on hire-purchase, 218—total, 3349. Prepayment cookers on simple hire, 5489; do. on hire-purchase, 107—total, 5596. The totals for 1911-12 were: Ordinary, 3318; prepayment, 5208. The number of public lamps in use last year was 2716, of which 19 self-intensifying and 40 high-pressure were in Southport.

At the meeting of the Town Council last week,

Alderman TROUNSON moved the minutes of the Gas Committee, and, commenting on the report on the working of the gas undertaking in the year ended March 31, said that a satisfactory feature was the increase in consumption. The sale of gas had gone up about 24 million cubic feet—being 4·62 per cent. increase. On the prepayment system, it was 12·49 per cent.; so that they must remember, when they made any concessions in the price of gas, they were dealing with a large number of a poorer class of people. The capital outstanding was 6s. 11d. per 1000 cubic feet, against 7s. 3d. last year; but until they could further reduce this charge, they would never be able to sell gas very cheaply. With this object in view, they were charging fresh expenditure to revenue; and in spite of this fact, they had been able to pay their contribution of £13,000 towards the relief of the rates, and at the same time had succeeded in having the very favourable balance in hand of £3557, after meeting their liabilities. The Committee had decided to allocate this, together with £1500 from the reserve fund, towards the reconstruction account; thus wiping off a sum of £5000. It was hoped that the vertical retort plant would be ready for work by the 30th of September; and it would be necessary for the retorts to be ready at an early date, because if they started then they would have six months' working. They were going to have a very stiff year—possibly the stiffest they had had for some time past, because, in addition to the usual £13,000 which went to the relief of rates, the Council recently asked them to contribute a further £1000; and on the top of this again must be added an additional £7000 expenditure due to the increased cost of carbonizing material. Then, again, £3500 of revenue had been lost by the recent reduction in the price of gas. The total thus required for the Gas Estate to make was £24,500 to meet their liabilities. They had also set themselves the task of contributing £4000 towards the reconstruction account, making a total of £28,500; and after paying on account of interest and sinking fund about £14,000, this would require a gross profit of £42,500. He was not croaking about it at all. He wanted the Council to realize now what it was the Council had imposed on them. If it could be done, they had in Mr. Bond and his staff the men to do it. The Committee had every confidence in Mr. Bond and the staff. All the men were working right loyally, and they would get the best out of them that they possibly could. He concluded by again paying a compliment to Mr. Bond and the staff, and said the Gas Estate was never in a more satisfactory condition than it was now.

The minutes were adopted.

WEST BROMWICH GAS UNDERTAKING.

Financial Position.

An interesting review of the position of the gas undertaking of the West Bromwich Corporation is given by the Borough Treasurer (Mr. H. Kirk) in his annual abstract of the accounts of the Corporation, issued last Thursday. He points out that for the financial year ended March 31 the income of the gas undertaking was £62,792, while the expenditure amounted to £49,684; leaving a gross profit of £13,108. Of this sum, £5028 was required for the sinking fund and £3256 for interest on capital; thus leaving a net profit of £4824 for appropriation. A sum of £500 was transferred in aid of the general district rate for 1913-14; and the balance of £4324 was carried forward. During the year, the capital expenditure account was increased by £269; the total now being £241,335. The loan debt outstanding totalled £129,207, towards which there was a sum of £21,157 in the redemption fund. The discounts and allowances came to £2183; and the bad debts contracted during the year only amounted to £11 13s. 4d.—a remarkably low figure.

Increased Appreciation of High-Pressure Gas—The Billiard-Hall Installation.

High-pressure gas is growing enormously in public favour at West Bromwich, and the Gas Engineer (Mr. Harold E. Copp) and his staff are just now having a busy time in coping with the increasing demand and in fitting up tradesmen's premises for the winter season. Many large consumers in the borough who were attracted away from gas under the old *régime*, and introduced electricity into their establishments, are now installing high-pressure gas; and the Gas Committee feel that the patronage already has been remarkable. One of the most successful installations of high-pressure gas has just been completed at the new Billiard Hall erected by Messrs. Willie Holt (Burnley), Limited, to which reference was made in the "JOURNAL" last week, and which was opened on Wednesday afternoon. There are 23 full-sized tables, each lighted by three lamps of 100-candle power. The gas consumption at each table will be only about 1¾ cubic feet per hour. The pressure is obtained from the Corporation station. The Gas Committee hope they will do even better with high-pressure gas than they have done since they introduced it for the public lighting of the borough at the end of last September.

BURTON-ON-TRENT GAS-WORKS MANAGEMENT.

Mr. R. S. Ramsden's Position Improved.

At the Meeting of the Burton-upon-Trent Town Council, last Wednesday, considerable discussion ensued upon the recommendation of the Gas and Electricity Committee that the salary of Mr. R. S. Ramsden should be at once increased by £25 per annum, and further increased by a like amount next year and in 1915; and that the prefix "Assistant" should be dropped from his official title.

Alderman LOWE, the Chairman of the Committee, moved the approval of these recommendations. He said that Mr. Ramsden was appointed in January, 1907, as Assistant-Manager, though it had to be remembered that he had been acting in this position temporarily during the period of his father's illness—viz., two years. He was appointed at a salary of £180, and this was subsequently increased to £200; and a little more than a year ago a further advance of £25 was granted him. The Council would recollect that at the time the appointment was made it was understood by every member that if Mr. Ramsden, who was then a young man, proved satisfactory in the position, fully capable of carrying out the important duties, and equal to the responsibilities, his salary would have to be considered in a rather broad spirit. He (Alderman Lowe) could conscientiously say that Mr. Ramsden had fully qualified himself for the position. Since his appointment, he had had seven years' strenuous training under Mr. Bell, their Consulting Engineer, and he had devoted himself to the work whole-heartedly and had done extremely well. It was for this reason that they proposed to drop the word "Assistant." If they had a man in a position of considerable responsibility, he should be paid in some proportion to the responsibility and for the duties he was called upon to fulfil. He (Alderman Lowe) held a sheaf of replies from various gas companies and corporations up and down the country, and there was not one corporation out of them

all who had one-half the output the Burton Corporation had—viz., 200 million cubic feet—who did not pay their Manager £300 a year. In addition, there was not one corporation or one company in the list with an equal output to that of Burton (400 millions) who did not pay their Manager £500 a year. He had been told that the fact that they had Mr. Bell as Consulting Engineer altered the whole aspect of the matter. He admitted that it had a considerable bearing on the case; and when the Committee recommended that Mr. Ramsden's salary should be increased to £300 per annum they were having regard to the office of Mr. Bell, and did not propose to give Mr. Ramsden a salary adequate to the management of a gas-works of a town of the size of Burton. It was almost impossible to reckon the value of Mr. Bell's services to the Corporation. He was not only connected with the Derby Gas Company, but with many other gas undertakings; and his having the control of the purchase of very large quantities of coal placed the Committee in a position to buy their coal at comparatively low prices. These were advantages which would pay Mr. Bell's salary over and over again. The advances proposed were three annual ones of £25, raising his salary from £225 to £300; and the Committee regarded them as most reasonable amounts. The duties had greatly increased since Mr. Ramsden started. Their output had increased from 320 to 380 million cubic feet; and, in addition, the whole principle of gas management had changed in the last few years. Instead of waiting for customers, they advertised their concern in the same way as any other commercial undertaking. This meant an enormously increased call upon the Manager. He believed the Council would unanimously vote for the increase in Mr. Ramsden's salary. Even then it would not be nearly so large as those of officials in similar undertakings; but it would serve as some recognition of his services.

Mr. TARVER seconded the motion.

Mr. THORNLEY asked for some understanding as to the length of the tenure of office of Mr. Bell. He thought the time had come when they should receive a promise of the discontinuance of the payment to him of the present extraneous sum.

Mr. HUTCHINSON expressed his confidence in Mr. Ramsden, but said he could not bring himself to vote for three annual increases of £25 per year. He did not believe in going so far as three years ahead. He had always looked upon Mr. Bell's appointment as temporary. If Mr. Ramsden was to take upon himself the full responsibility of Manager, the salary of £300 per annum, with £100 extras, would not be large; but he (the speaker) did not consider that Mr. Ramsden could be regarded as more than Works Manager while they employed Mr. Bell. He proposed, as an amendment, that the increases be considered as only for two years.

The amendment was not seconded.

Mr. TARVER said the question should be considered entirely on its merits. It was a case of whether Mr. Ramsden was worth the money or not. The speaker proceeded to give statistics relating to the salaries of previous gas managers and the respective quantities of gas sent out by them. He said the Council had heard a great deal of Mr. Ramsden's most satisfactory services, and felt he was well worth the increase they proposed. The services of Mr. Bell had paid for themselves over and over again. They had not yet completed their reconstruction scheme, and therefore it would be most unwise to dispense with Mr. Bell. Had they gone to another engineer, his work would have cost them a very great deal more than the few hundred pounds they paid him.

After some further discussion,

Alderman LOWE replied. He said he was certain that Mr. Ramsden was fully capable of managing the whole of the gas-works; and he did not think he was being paid nearly so well as managers in many other towns. During the past eight or ten years, the actual gas profits had more than trebled. Therefore he did not think the Council should have taken the time they had to arrive at a decision.

The motion was then put and carried with only one dissentient—Mr. Hutchinson, who explained that though he was in favour of the increase for two years, he objected to it being extended over the third year.

A TEN-FEET GAS FLARE IN GLAMORGAN.

Named in honour of Mr. A. Thau, the coke-oven expert at the Llwynypia Coke-Ovens, the "Thau Torch"—a ten-feet flare—illuminates the whole of the Mid-Rhondda district at night. The torch is merely the waste gas from the coke-ovens—a matter of 2 million cubic feet a day.

According to the "Western Mail," its glare shows up every detail of the Glamorgan colliery buildings at night, and makes a picture not easily described, as it shows lofty stacks and fine buildings in the foreground, with a dark, bold background in the surrounding noble hills. The daily make of gas is 4 million cubic feet, half of which is used in the coke operations. The remainder will for the present be "wasted in this magnificent manner" until the Rhondda Council decide whether to purchase it or not. The supply has been offered to them in its purified state for 7½d. per 1000 cubic feet—costing the Council £62 10s. a day. At their retail rate to ordinary consumers the quantity available would produce a gross revenue of over £400. But, of course, from this must be deducted the cost of storage and other items. Or, computed on the penny-in-the-slot basis, it would provide 125,000 Rhondda residents with a pennyworth of gas a night, and give the Council a revenue of £520 16s. 8d.—a handsome return on an expenditure of £62 10s.! Failing the Council's acceptance, the Cambrian Combine will, it is said, utilize the gas for their own purposes.

Oldbury Gas Undertaking.—Mr. Adam Cooke, the Engineer and General Manager of the gas-works of the Oldbury Corporation, has now, we are pleased to learn, completely recovered from his recent severe illness, and is able to attend to his duties as usual. The alterations and improvements at the gas-works are now practically finished for the season, and everything is going on satisfactorily. The demand for gas for both lighting and power purposes continues to increase.

FATAL GASSING OF GASHOLDER REPAIRERS.

Last Tuesday afternoon, while some workmen employed by Messrs. Clayton, Son, and Co., Limited, were engaged in repairing a holder at the New Wortley Gas-Works, Leeds, a gassing accident occurred which unfortunately resulted in the loss of two lives. It appears that the holder had been pumped for about a fortnight, in order to clear it of gas; and it was thought to be quite safe for the workmen to enter. Three of them did so, and worked for about twenty minutes, when cries were heard for help. The foreman—Peter Carry (or Kelly)—at once ascended the holder, which was up something like 70 feet, entered it, and went down by a rope ladder to the platform on which the men were working. On reaching it, he found them in a state of utter helplessness. He passed a rope round one man, who was drawn up; a second being similarly treated. Then Carry unhappily was overcome and lost consciousness. Being a very heavy man, he could not be got out until the holder was lowered; and this was done as quickly as possible. Meanwhile, more help had arrived, including members of the Fire Brigade, who did all that was in their power to rescue the unfortunate men. Assistance was also given by the two men withdrawn from the holder, who quickly recovered on getting into the fresh air. Even with the holder lowered, the task of getting the men out was one of great difficulty and risk. Eventually, through the bravery of Sergeant Horne and two police-constables, named Taylor and Spirrett, Carry and the other man, named Nicholson, one of Messrs. Clayton's regular employees, were brought out. Attempts at resuscitation were at once commenced; but they were unavailing. Both bodies were removed to the mortuary to await the inquest.

The reporter for the "Leeds Mercury" gave a graphic account of the firemen's rescue work. He said: The work of the firemen was particularly plucky; and had the brigade's assistance been sought earlier, it is probable that the two lives would have been saved. The fire station ambulance was first despatched; but on arrival the driver learnt that the men were lying at the bottom of the gasholder and could not be touched. No effort could be made immediately to reach them; so the firemen were called, and a section, comprising Sergeant Horne, and Police-constables Taylor and Spirrett, arrived by motor with two smoke helmets. The firemen mounted the holder, which, by this time, had been lowered, and prepared to enter through the manhole. But it was impossible, or, at least, inconvenient, to wear the smoke helmets, as the inlet tube was only 21 inches square and 4 feet long. Sergeant Horne volunteered to descend the rope ladder without the helmet; and in pitch darkness he searched along the staging at the bottom till he reached a body, which proved to be that of Carry. It was lying face downwards, entangled by some yards of rope which had coiled upon it as the holder was lowered. Horne disengaged the man and turned him over; then, feeling the effects of the fumes, he ran for the manhole. Taylor took his place, having received directions as to the position of the body. Carry was a heavy man (weighing some 16 stone) and Taylor, who took a rope with him, had the task of lifting the man from below, accompanying him up, and guiding his head into the narrow tube. The body was at last extricated, and then Taylor emerged. Only five minutes were occupied in the work of rescue, and artificial respiration was at once begun under the direction of Dr. Partridge, of the Infirmary. Spirrett went down next; and in a minute or two he felt the effects of the gas. But before he returned he located Nicholson's body, and a civilian (understood to be one of Messrs. Clayton's employees) received his directions and went down to recover it. He fastened a rope about the body, and guided it to the manhole as Taylor had done at first. Attempts at resuscitation were begun at once, and after some time a hope was entertained that Nicholson might recover, as he did not seem to be so badly affected as Carry. But he never regained his senses.

The Inquest.

An inquiry into the circumstances attending the fatality was conducted last Friday by Mr. J. C. MALCOLM, the Leeds City Coroner. Mr. C. F. Wright, one of the Inspectors of Factories, was in attendance.

Dr. *H. R. Partridge*, of the Leeds Infirmary, said he was called to the Wortley Gas-Works with the ambulance on the previous Tuesday afternoon, and found Carry and Nicholson inside the holder. Carry was dead, and Nicholson was unconscious, displaying the ordinary symptoms of gas poisoning. He tried artificial respiration for an hour, but without avail.

Dr. *Woodcock*, who had conducted a post-mortem examination, said both men were strong and healthy, and in each case the cause of death was carbon monoxide poisoning.

Mr. *J. J. Baines*, Director and Secretary to Messrs. Clayton, said the nature of the work was repairing the middle cup of the gasholder, which was constructed fifty years ago, and enlarged by his firm about twenty-six years ago. He did not know that a fatality had occurred then. Carry was the foreman on that occasion. The holder had since been repaired by them. On the 28th of July they opened the manholes at the top, and for a fortnight air was blown through; the blower, which discharged about 72,000 cubic feet per hour, working for nine hours each day. It was left to Carry to determine when the men should enter the holder.

Mr. *W. H. Gardner*, Outdoor Superintendent for the firm, questioned by the Factory Inspector, said he thought the aperture at the top of the holder was sufficient to ventilate the holder effectively.

The INSPECTOR: You know these men were 75 feet down, with a 30-feet tank of water underneath? Don't you think they should have been provided with proper helmets?

Witness: We have never done so. We could not use them in our class of work.

Would there have been less likelihood of this foul gas being present in the holder if the water had been drawn off and fresh water put in?—Yes.

Why was it not done?—That I could not say. It was not done on the previous occasion.

G. H. Sandaver, one of the workmen, said he and Carry were standing outside the holder; two men having been sent down to indicate by means of knocks the number of rivets requiring attention. The knocks were given all right at first, but they afterwards ceased; and to witness's murmured hope that there was "nothing wrong," Carry replied, "Oh, no; she's as sweet as a nut." At this juncture there was an outcry at the top for Carry, and witness went out of the yard to obtain assistance. The height of the holder, however, seemed to frighten the men he obtained.

Thomas Barlow, one of the rescued men, said he was working with Nicholson on the floating platform inside the holder, and after they had been there half-an-hour they began to feel dizzy. Witness thought it was the heat of the sun on the holder. Continuing his story he said: "We agreed to go up, both feeling it too much. I climbed up the rope-ladder about 20 feet; but I began to lose my breath, and came down again. When I rejoined Nicholson, he said, 'I am getting drunk.' The man at the top—Bywater—lowered a rope to me, and with his assistance I got to the top, where I fainted." Witness added that he afterwards went down into the holder three times. Carry had also gone down to try to bring up Nicholson, but was entangled with the rope and the rope-ladder.

Bywater next gave evidence. He said he saw Carry trying to tie the rope round Nicholson's waist, when the latter fell forward and knocked Carry into the water. He scrambled back, and fastened Nicholson to the rope, and Nicholson was then pulled up. The rope was again lowered, and Carry fastened it round himself. When witness last saw him, he was swinging round.

Mr. *F. W. Hunt*, a Factory Inspector, said he was in the neighbourhood on the afternoon of the accident, and arrived in time to see Bywater being pulled up out of the air-box. He collapsed; but as soon as he came round he wanted to go down again to Carry's assistance. Witness, however, prevented him. A man named Briggs was also at the top, in an almost unconscious condition. Witness successfully tried artificial respiration upon Barlow, whose pulse was very poor. He also telephoned for oxygen apparatus from the Infirmary and from the Farnley Iron-Works, and communicated with the Fire Brigade.

Sergeant *J. Horne*, of the Leeds Fire Brigade, said he went down into the holder without his smoke helmet. He found Carry lying on his face, with the ropes coiled on the top of him; but before he could do anything he began to feel dizzy and sick, and came out. Police-Constable Spirrett and another man afterwards went down.

The Coroner, in summing up, said that nothing had been wanting in regard to the courage of these men in assisting one another. All concerned seemed to have been reckless of their own lives in their attempts to succour and relieve the others.

Mr. Wright said the actions of Barlow, Bywater, and the man Briggs were particularly brave; and he should consider it his duty to represent to the proper parties that some special recognition should be given to these men.

The Jury, in returning a verdict of "Accidental death," expressed their concurrence with the remarks of the Coroner.

Mr. Baines, on behalf of Messrs. Clayton, and Mr. Green, on behalf of the Leeds Corporation, expressed their sympathy with the relatives of the two men.

GAS WORKERS' ORGANIZATION IN THE MIDLANDS.

Plentiful evidence is being afforded just now of energetic attempts which are being made by officials of the National Amalgamation of Gasworkers to bring all the available units within the trade union fold; and although notoriously the beating of the drum has not been responded to in some quarters with the alacrity which is desired, it is claimed that the results achieved in the East Midlands district, of which Nottingham is the centre, have been eminently encouraging. The official figures disclose that in the past quarter 1089 new members were enrolled; bringing the total up to 4627 in this part of the Midland area. As, however, the organization embraces within its scope also general labourers, it must be assumed that a very considerable proportion of the increase is due to the accession of workers who fall within this comprehensive section of the Society's operations.

In this general connection, it is recorded that the period under review has been the most successful ever experienced by the district, and that concessions have been obtained at Woolsthorpe, Ab-Kettleby, Stanton, Gotham, Grantham, and Derby. New branches have been formed also at Melton and elsewhere. It is the proud boast of Mr. W. Thorne, M.P., the General Secretary, and his former West Ham colleague, Mr. Arthur Hayday, who exercises secretarial control in the Nottingham district, that practically all the gasworkers in the service of the Nottingham Corporation are now within the ranks. But it is a striking commentary upon this much-vaunted solidarity that a closely-allied branch of trade union organization, represented by the tinplate workers on strike at the Nottingham meter repairing shops, have been left to their own resources in a hopeless struggle. The members of the Amalgamation of Sheet Metal Workers, in their endeavours to cripple operations at the Corporation's Woodborough Road depôt, have at length realized to their chagrin how little reliance can be placed on promises of mutual support. If frothy declamations could have had the desired effect, the Gas Committee might, figuratively speaking, have been long since decimated. But fulminations of the customary character have not been permitted to interfere with the conduct of the municipality's chief trading concern, while the fight which the meter repairers have been ineffectively waging has been above all significant as illustrating the hollowness of trade union platitudes when a question of concerted action is involved.

Melton Mowbray Gas Company.—The revenue account of this Company for the year ended the 30th of June last shows a profit of £2204, and the profit and loss account a balance of £5602. The usual dividend of 7½ per cent. has been declared. During the year, 4854 tons of coal were carbonized under the supervision of the Manager of the works (Mr. G. R. Casterton).

GAS COOKING IN THE YEAR 1869.

Writing in the "Co-Partnership Journal of the South Metropolitan Gas Company," the Editor (Mr. Walter T. Layton) remarks: From time to time we have given publicity to various items of information, usually derived from little known sources, concerning the rise and progress of gas cookery. A few weeks ago one of our periodic searches for copy among a waste of second-hand literature brought to light an interesting book "On the Extravagant Use of Fuel in Cooking Operations," by Frederick Edwards—published in 1869. The author, who seems to have been something of an authority on the subject of coal and its combustion, referred to "Gas Cooking Stoves" in the following terms:—

> A few years since, many persons entertained the idea that the gas in use for lighting would become a substitute for coal in the preparation of food; but their expectation is very far from having being realized. There was something novel and striking in the idea of one being able to obtain a supply of heat instantaneously merely by applying a match, and of discontinuing the heat as suddenly by turning a tap. Gas was used in ovens for cooking joints and baking; a row of gas-jets being provided all round the bottom, with hooks or shelves to carry the joints, and a dripping-pan below. Gas was also made to burn in a sheet of flame for broiling or toasting; and it might have succeeded in supplanting coal to an enormous extent if there had not been an insuperable difficulty, and that was the expense. Let those who are partially disposed say what they may, carburetted hydrogen gas used for heat cannot for a moment compare in economy with the solid fuel from which it is made. It is not a question of coal used extravagantly and gas used economically. Both should be used with care if a proper comparison is to be made. But, even with our extravagant method of using coal, gas has not held its ground; and this is due not merely to the expense incurred in producing the gas, but to the fact that the rejected part of the coal used in making the gas is exactly that from which we obtain nearly all our heat—viz., the carbon which the gas companies leave in the form of coke. When the ingenuity of man can succeed in readily converting a whole body of coal into inflammable gas, we may entertain the hope of such gas competing successfully with the coal itself; but probably not otherwise. Gas is used to some extent for cooking in many large establishments; and in some hotels, dining-rooms, and clubs, chops and steaks are sometimes broiled over rows of gas-jets instead of over a common fire, and for family use gas has sometimes been introduced to supersede the use of charcoal stoves. . . . The author has alluded to this and other matters from a desire to make his information as complete as possible; and he only trusts that some substantial good may result from his attempt to awaken interest in this much neglected department of domestic economy.

Such were the views of an intelligent writer only 44 years ago. It should be borne in mind that gas was at that time much higher in price than it is now, and also that very few gas companies took much interest in the application of gas to any purpose beside illumination. Those were days when there was no sliding-scale; neither was there any competition with electric light. Less than ten years later cooking by gas was being pushed with considerable vigour, and the development of gas-stoves was proceeding on something like scientific lines. Soon it was demonstrated conclusively that for cooking food gas was cheaper than coal, as well as more convenient.

Sutton Gas Company.—The Directors record a satisfactory increase of business (six million cubic feet) during the first half of this year, though the abnormal increase in the price of coal has resulted in extra expenditure. Residuals realized £377 more; and the revenue from all sources was up by £1200. A dividend at the rate of 6 per cent. per annum is to be paid, out of an amount of £6738 available for the purpose.

Rhyl Gas Supply.—At the meeting of the Rhyl Urban District Council on Monday last week, Mr. S. Perks, the Chairman of the Gas Committee, drew attention to the report on the gas undertaking recently issued, and noticed in the "Journal" last week (p. 453). The report, he said, was eminently satisfactory, for it showed the expansion and progress of Rhyl. During the past two years, there had been an increase in the make of gas of 4 million cubic feet, or 3½ per cent. This had been done without any great increase in the cost of coal, for every ton carbonized made 12,461 cubic feet, of which they had sold 11,401 cubic feet. The financial result had far exceeded expectations; £3175 being handed over in relief of the rates for one year, equal to a rate of 1s. 1d. in the pound. The Council should congratulate the Gas Engineer (Mr. Leonard G. Hall).

Lighting of Truro.—A discussion took place at the meeting of the Truro City Council last Tuesday on the subject of the public lighting. A letter was read from Mr. S. J. Ingram, the Manager of the Gas Company, offering to renew the contract for the coming year with the substitution of Aug. 1 to May 15 for Aug. 16 to May 15 as the period during which the midnight lamps are to be lighted; the charge to be for midnight lamps £2 1s. 3d. per lamp, and for all-night lamps £3 13s. per lamp. The Lighting Committee recommended that the offer should be accepted, but that a clause should be inserted in the contract to the effect that if electric light should be installed within the period covered by the contract, the Council should be at liberty to determine the contract by giving one month's notice. Mr. W. A. Parkin remarked that the cost of the all-night lamps had been £3 11s. 6d., and now it was to be £3 13s. Mr. Ingram had told the Council, when discussing with them the subject of electric light, that if the Gas Company did not succeed in their application for power to supply electricity the shareholders would not be out of pocket, but that the consumers would have to pay. He congratulated Mr. Ingram on having prophesied correctly. The Town Clerk said the suggestion of the Committee as to the insertion of a clause in the contract with regard to the electric light had been communicated to the Gas Company. Mr. Ingram replied that the Company could not accept the condition that the Council should be at liberty to give a month's notice should the electric light be installed within the period of the contract, with, he presumed, a proportionate reduction for the unexpired period of the contract. He said it was not likely that the electric light would be installed in the forthcoming twelve months; and the question of the proposed condition might be left to the next contract. The Council approved of the contract without the suggested clause.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Glasgow.—The Watching and Lighting Committee have recommended that application be made to Parliament in the next Provisional Order to be promoted by the Corporation for power to get full control of the lighting of private streets, courts, and common stairs, and to meet the expenditure connected therewith, and with the lighting of the public streets of the city, from a rate leviable equally between owner and occupier—the powers, if obtained, to come into operation as from the term of Whit-Sunday, 1922. The recommendation was not passed by the Town Council without considerable discussion, in which the principal point raised was the increasing rates to which both owners and occupiers were being rendered liable.

The Gas Committee have recommended that the members of the British Commercial Gas Association be invited to hold their annual meeting in Glasgow next year.

Another explosion has occurred through the use of a light by a plumber in looking for a leak. The gasalier was suspected as the cause of the escape; and on the plumber striking a match the explosion occurred. Every window in the room was blown into the street; but, fortunately, the plumber was not seriously hurt.

Bridge of Allan.—The Gaslight Company have not seen their way to accept the offer of the Town Council for the purchase of the gas-works, and have further declined to meet the Gas Committee. Arbitration proceedings will take place in October, when Mr. R. Cockburn Millar will act as Arbiter for the Town Council and Mr. Alexander Yuill for the Gas Company. The Counsel engaged are Mr. Avon Clyde, K.C., for the former body, and Mr. Frank Cooper, K.C., and Mr. J. B. Paton for the latter. Mr. W. R. Herring and Mr. Nelson are to be witnesses for the Town Council; but those for the Company have not yet been chosen.

Johnstone.—The Town Council have fixed the price to be charged for gas during the coming year at the same low figure as last year—namely, 1s. 10d. per 1000 cubic feet—notwithstanding the expenditure of a considerable sum of money in extensions at the gas-works and the rise in the price of coal.

Leslie.—The Town Council are to be commended upon a policy which might well be followed in many other places. The Gas Company are about to lay a new main; and the Town Council are to take the opportunity of putting down a water-pipe in conjunction with them.

Penicuik.—At the annual meeting of the Gas Company, presided over by Mr. Henderson, in the unavoidable absence of the Chairman, some shareholders raised the question of the payment of a larger dividend than 9 per cent., as the state of the finances seemed to warrant a higher distribution. Mr. Henry O'Connor, a Director, pointed out that, owing to the rise in coal and certain alterations and extensions, the shareholders could hardly expect so large a profit during the coming year, and it had been thought best to carry over a large sum for these purposes. This explanation was considered satisfactory, and the dividend was agreed upon. Mr. O'Connor was voted an extra fee for the professional work he had carried out on behalf of the Company.

Peterhead.—The Town Council are to be congratulated upon the steps they have taken to provide oxygen reviving apparatus and a respirator; so that in the event of any of their employees being gassed, there will be the best possible chance of their recovery.

West Kilbride.—A satisfactory increase in profits is shown by the report of the Gaslight Company for the year ended May 31 last, despite the increase in the price of coal. There is a profit, omitting shillings and pence, of £609 upon the year's working. The revenue amounted to £1922, and the gross expenditure, including coal and working expenses, to £1312. These figures are increases respectively of £177 and £161 when compared with last year. The dividend paid amounts to 6 per cent., free of income-tax.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 16.

Throughout the week the market for this material has continued to harden, and all parcels offered for sale have been keenly competed for at steadily advancing prices. No doubt, the fact of the present time being the season of minimum production has contributed to the strength of the situation, as fresh orders from direct buyers have not been plentiful. The closing values are £13 3s. 9d. per ton f.o.b. Hull, £13 5s. per ton f.o.b. Liverpool, and £13 6s. 3d. per ton f.o.b. Leith. In the forward position, there are buyers for October-December delivery at £13 7s. 6d. per ton, and for January-June at £13 10s. per ton f.o.b. at the ports, but producers are now holding for a further 2s. 6d. per ton.

Nitrate of Soda.

There is still no alteration in this market, and quotations are repeated at 10s. 7½d. per cwt. for ordinary quality and 10s. 10½d. for refined, on spot.

LONDON, *Aug.* 18.

Tar Products.

The markets for tar products are fairly steady, and there has been a slight improvement in some articles. Pitch has gone up a little; and makers are now fairly firm in their idea of value for delivery over the next six to twelve months. Benzols are quiet, although distillers are fast in their idea of value; but some reselling has transpired which has been the cause of depression during the past week. Naphthas are steady, but very little business is doing. Creosote is in fair demand, and prices keep very steady. In regard to crude carbolic, consumers are still unwilling to pay the present prices; but manufacturers are very firm in their ideas.

The average values during the week were: Tar, 28s. 9d. to 32s. 9d. Pitch, London, 43s. 6d. to 45s.; east coast, 43s. 6d. to 44s. 6d.; west coast, Manchester, 43s. to 43s. 6d.; Liverpool, 43s. 6d. to 44s.; Clyde, 44s. to 44s. 6d. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 1⅛d.; North, 11d. to 11⅛d.; 50-90 per cent., naked, London, 1s. to 1s. 0⅛d.; North, 11d. to 11⅛d. Toluol, naked, London, 10⅜d. to 11d.; North, 11⅛d. to 11⅛d. Crude naphtha, in bulk, London and North, 5⅛d. to 5⅜d. Solvent naphtha, naked, London, 10⅛d. to 10⅜d.; North, 9⅛d. to 9⅜d. f.o.b. Heavy naphtha, naked, London, 10d. to 10⅛d. f.o.b.; North, 9d. to 9⅛d. f.o.b. Creosote, in bulk, London, 3⅜d.; North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅛d. to 3⅜d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 3d. to 1s. 4d. Naphthalene, £4 10s. to £9 10s.; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1⅜d. to 2d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been some improvement in the market for this article during the past week, and prices have risen slightly at all ports. Outside London makes to-day are quoted at £12 6s. 3d.; Hull, £12 17s. 6d.; Liverpool, £13; Leith, £13 1s. 3d. to £13 2s. 6d.; while for the forward position, £13 7s. 6d. is generally asked.

"TAR DISTILLER" writes, under date of the 13th inst.: "Tar products are still maintaining quite good average prices, and buyers are very numerous in their requests for offers of pitch. There is no doubt that the next few weeks will see a big rise in prices; 43s. Manchester and 44s. Liverpool have been refused."

COAL TRADE REPORTS.

Northern Coal Trade.

There is a good demand for coal generally, and the production is rather checked by the numerous local holidays, so that prices on the whole are firm. For steam coals, best Northumbrians are from 15s. 3d. to 15s. 6d. per ton f.o.b.; second-class steams are about 13s 6d.; and steam smalls are from 8s. to 9s 9d. per ton, according to class—the demand being rather fuller for small coal for export. The inquiry is now steadily growing for gas coals, both for home and for export. Best Durhams are from 15s. per ton f.o.b.; second-class gas coals are from 13s. 6d. to 13s. 9d. per ton; and "Wear specials" from 15s. 3d. to 15s. 6d. per ton f.o.b. A contract for Portovecchio, for 11,000 tons of best Durham gas coals, at 24s. per ton, has been concluded for delivery early at that Mediterranean centre. Some other sales of cargoes for that part are expected; and the easier freights are making sales a little more frequent. For forward delivery, however, the users look for concessions in the quotations. The local consumption of gas coals shows a more steady growth. Coke is generally quiet. Gas coke is in fair demand at 17s. to 17s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

The demand for Scotch coal of all classes has continued good during the past week. In the Lothians, the output has been restricted owing to the strike of dock labourers at Leith; but with the settlement of this trouble last week, things are resuming their normal complexion. The following were the prices quoted f.o.b. Glasgow on Thursday: Ell, best brands, 12s. 9d.; splint, 12s. 9d. to 15s.; navigations, 15s. to 16s. 6d.; steams, 11s. 6d. to 12s. 9d.; Hartleys, 14s. 3d.; trebles, 13s.; doubles, 12s. to 12s. 6d.; singles, 11s. to 11s. 3d.; pearls, 10s. 6d.; dross, 8s. to 8s. 6d.

Spalding Water Supply.—The Local Government Board have communicated with the Spalding Rural District Council sanctioning a loan of £14,000 for a water scheme for the parishes of Moulton, Weston, Pinchbeck, and Pinchbeck West. The loan includes provision for the purchase-money of the works of the South Lincolnshire Water Company, so far as they are in the Spalding Union area; the purchase price having been fixed at £2000. The balance will provide for the linking-up of the existing mains, and for considerable extensions to different parts of the parishes mentioned.

Barry Water Supply.—The question of obtaining a new water supply for Barry was reopened at the meeting of the Barry District Council last Tuesday owing to the position caused by the powers recently obtained in Parliament to supply water to any works which might be erected on new land acquired by the Barry Railway Company. The Water Engineer (Mr. T. D. Franklin) pointed out that to continue with the present supply might entail the expenditure of £50,000 in the near future. The storage reserve at present would only last two days. After a long discussion, the following resolution was adopted: "That in the opinion of this Council it is desirable that a supply of soft water for the district should be obtained."

Water-Works Loans for St. Helens.—Last Thursday, a Local Government Board inquiry was held at St. Helens into (*inter alia*) an application to borrow £9658 for water-works purposes. The Water Engineer (Mr. J. J. Lackland) said that the last sanction to borrow was obtained by the Water Committee in October. 1905. Developments were always going on; and the whole of the amount borrowed had been spent. Then the Committee had overspent an amount of £4658 on the purchase and construction of the Melling pumping-station. They met with unexpected difficulties in the bore holes—striking the rock about 30 feet from the surface, and then encountering several strong springs of water, which made the work difficult. Two bore holes of 24 inches in diameter were sunk to a depth of 560 feet. In 1902, when putting the last pipe on the pump, the tackle broke, and the 200 feet long pump went down to the bottom of the bore hole. After a lot of grappling it was raised undamaged, and had worked continuously since August, 1903. The station produced 1,500,000 gallons of water per day. The original idea was that the pumps would raise 1,000,000 gallons a day; but they had easily given the larger quantity named. The total expenditure on the station had been £30,658.

Tyldesley-with-Shakerley Gas and Water Supply.

According to the annual report of the Engineer and Manager of the Gas and Water Departments of the Tyldesley-with-Shakerley Urban District Council (Mr. Hedley Hoy), the gross profit from the gas undertaking in the year ended the 31st March last was £2540, and the net profit £475, which has been added to the reserve fund. The gross profit is at the rate of 14·7 per cent. on the capital employed; and the capital charges are at the rate of 10·62d. per 1000 cubic feet of gas sold. The total quantity sold was 46,663,300 cubic feet, out of a make of 54,324,000 cubic feet, of which 1,669,000 cubic feet were water gas; the raw material used being 5061 tons of coal and 5436 gallons of gas oil. The quantity of water gas made was less than before; the plant not having been brought into full use owing to the exceptional demand for coke and to the exorbitant price of oil obtaining. There was a loss of £68 on the Water Department in the past year. The total quantity of water purchased from Manchester was 213,255,000 gallons—an increase of 2,642,000 gallons compared with the year 1911-12. The receipts for water were £5263, or £192 more than before.

Rochdale Gas-Meter Inspectors' Wages.—The gas-meter inspectors at Rochdale have presented an application to the Gas Committee for an increase in pay. They point out that the wages in Rochdale are 31s. per week, against 36s. at Birkenhead, 35s. at Manchester, 34s. at Leeds, 33s. at Bolton, and 32s. 6d. at Barrow-in-Furness. It is further pointed out that in these towns the inspectors are allowed certain incidental expenses, such as tram fares, &c. The matter was referred to the Works Sub-Committee.

Grays and Tilbury Gas Company.—The ordinary half-yearly general meeting of this Company was held on Monday last week. The Chairman (Mr. F. E. Bartlett), in moving the adoption of the report and balance-sheet, congratulated the shareholders upon the excellent results of the half-year's working, though the prices of coal and other materials were considerably higher than before. The revenue account showed a profit of £3579; and after providing for interest on debentures and for bad debts, and placing £330 to the renewal fund, there remained a net balance of £6441. Dividends at the rate of 8½ per cent. per annum on the "A" shares and of £5 19s. per cent. per annum on the "B" shares, less income-tax, were recommended. These would absorb £2641; leaving £3800 to be carried forward. The quantity of gas sold showed an increase of 11·99 per cent. over the corresponding period of 1912. Referring to the Bill promoted by the Company, the Chairman expressed his pleasure in stating that it had been passed by Committees of both Houses of Parliament, and would receive the Royal Assent in the course of a few days. The report was adopted, and the dividends recommended were declared. A hearty vote of thanks was unanimously accorded to the Directors, the Secretary (Mr. W. F. Whittaker), and the Engineer and Manager (Mr. A. W. Sumner), for the very efficient manner in which they had conducted the business of the Company during the half year.

Salford Gas Consumers' Deposits.—In a recent discussion at the Salford Town Council on the question of the deposits of gas consumers, it was stated by Alderman Phillips, the Chairman of the Gas Committee, that the Borough Treasurer held upwards of £15,000 which had been deposited during the last quarter-of-a-century. It is believed that quite half this amount will never be claimed.

Camborne Gas Company.—The annual general meeting of this Company was held last Thursday—Mr. F. W. Thomas presiding. The Directors recommended the payment of a dividend of 3 per cent. for the half year, making 5½ per cent. for the year, and leaving £161 to be carried to the next account. The Chairman said that upwards of 30 million cubic feet of gas were manufactured last year. There was a large increase in the number of prepayment meters installed; and he was of opinion that the Company must now depend more upon the small consumer. He did not think the Directors would be in a position to recommend a reduction in the price of gas for some considerable time, on account of the continued high price of coal. The report was adopted.

Heywood Electricity Works a Failure.—The Heywood Town Council last week confirmed resolutions previously passed to purchase electricity in bulk from the Bury Corporation. The town has electricity works of its own at Hind Hill; but it is admitted they are on an unsuitable site, and are never likely to pay. So that, if the new agreement with Bury works out as is anticipated, the plant at Hind Hill will probably be scrapped. The electricity losses at Heywood during the past few years have been very serious, and have handicapped the town. The projected supply of electricity in bulk will mean a capital expenditure of about £12,000 in transforming plant, &c.; but after the interest and sinking fund allowances for this are provided for, there will be, according to an official estimate, a saving of £1388 annually. Mr. J. Ashworth, the Chairman of the Committee, in giving an explanation why their electricity and tramways undertakings had been a failure, said: "Heywood, like other towns, has suffered through bad expert advice."

Tandragee (Co. Armagh) Water Supply.—In reply to a communication from the Local Government Board for Ireland, the Tandragee Urban District Council have expressed their willingness to join with the Rural District Council in providing a proper water supply for the district at a reasonable cost, urging that it is not necessary to hold an inquiry into the matter, as had been suggested by the Duke of Manchester and other property-holders in and about the town. The Council stated that, according to evidence given at a previous inquiry, including that of the Medical Officer of Health, they were unable to provide a proper supply without the co-operation of others interested. Complaints have been frequent of enteric fever and other infectious diseases arising from impure water, and Professor E. J. M'Weeney, of the Bacteriological Laboratory, Dublin, had shown that micro-organisms existed in the present supply from wells in the district, and impressed on those concerned that a new and pure supply was a matter of urgent public requirement.

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The Defective Chandelier Again.—An escape of gas from a defective chandelier in a house in Grove Road, Atherstone, caused an explosion on Sunday, the 10th inst. The house had only just been occupied again after the absence of the tenants, and the gas which had accumulated in the drawing-room, was fired by a lady and a friend who were seeking for the escape with a light. Practically everything in the room was wrecked; but the ladies escaped with a severe shock and slight burns.

Holywood Water-Works Extension.—The Holywood (co. Down) Urban District Council recently had under consideration a resolution to apply to the Local Government Board for Ireland for sanction to a loan for acquiring lands and water in the valley of the Ballykeel River, and the construction of a reservoir and subsidiary works; parliamentary sanction to be also obtained for the proposed extension. It was decided, however, to postpone action until further details of the scheme were submitted.

Bedford Gas Company.—At the 158th half-yearly meeting of this Company last week, the Directors reported that, although working under the difficulties of unusually high-priced coal and increased cost of labour, the results for the half year to June might be considered satisfactory. The sales of gas amounted to nearly 106 million cubic feet; the consumers having increased to 6118, or 334 more—of whom 180 have had slot meters supplied since Christmas, bringing up the number of prepayment consumers to 3808. The cooking-stoves in the district now number 2632, or an increase of 275 during the half year.

Strike in Milan.—In connection with labour troubles in Italy, a general strike was proclaimed in Milan on Monday last week in a manifesto issued by the Syndicalist Socialists. Troops concentrated in the city from Lombardy and Venetia, however, placed an overwhelming force at the disposal of the authorities; and they assisted the police to repress riots and arrest the rebellious strikers. Measures were taken to ensure a sufficient gas supply to illuminate the town indefinitely; but the authorities were powerless to prevent wanton damage in the outlying districts, where the lamp-posts were smashed and the gas-pipes cut. Fortunately the strike was only of short duration; being practically over by Tuesday, when men began returning to work.

Rochdale Gas Apparatus Show-Rooms.—At the recent meeting of the Rochdale Town Council, Mr. Bryning inquired whether it was the intention of the Gas and Electricity Committee to utilize the new show-rooms for the exhibition of electrical as well as gas apparatus. He also asked how far the Committee proposed to put into practice the Provisional Order which had recently been confirmed by Parliament, and which authorized the Council to supply and otherwise deal in gas-fittings. Mr. Ogden, who replied in the absence of the Chairman of the Committee (Mr. Walker), said the show-rooms would be used solely for gas purposes. It would be a matter for future consideration as to how far the Provisional Order for trading in gas-fittings should be put into operation.

Peterborough Gas Company.—Out of an available balance on the profit and loss account of £10,116, the Directors at the meeting of shareholders last Tuesday recommended, and it was agreed to pay, the statutory dividends on the various stocks—absorbing £3513, and leaving £6603 to carry forward. Alderman D. H. Redhead, who presided, said that, in spite of the competition from the electric light, the Gas Company's prosperity continued; and it was nice for him to have the same tale to tell of big profits and good dividends.

Burton-upon-Trent Gas Undertaking.—At the meeting of the Burton-upon-Trent Town Council last Wednesday, Mr. Hutchinson, the Chairman of the Finance Committee, gave a *résumé* of the Borough Treasurer's report for the year ended March 31. He stated that the net surplus on the gas undertaking was £13,497, which was £1047 less than last year. Of this surplus, £6497 was placed to the reserve fund, and £7000 was transferred in aid of the rates. It was pointed out that the decreased surplus was due to a reduction in the price of gas and an increase in the cost of coal.

The Discount System on Gas Bills in Manchester.—According to the "Manchester Guardian," the system of offering discounts on gas bills paid within a given time after delivery, which came into operation in Manchester this quarter, continues to work satisfactorily, though, as was to be expected, it has led to a little misunderstanding in some households. Many people had become so wedded to the old system of collection that they forgot to pay until the last day for payment had passed. Then they paid their bills and pleaded for the discount allowance. This could not, of course, be allowed. Another point has arisen about which there has been a good deal of controversy. Assuming, for example, that the last day for payment was the 5th of August, should a cheque for the amount of the account drawn and posted on that date, but not received till next morning, be accepted as if paid on the prescribed day? The Gas Department say it should not, as the money did not come into their hands till too late.

The "Woe Waters" of Croydon.—The visitation of "woe waters" in the Caterham Valley this year lasted 100 days. This information is given in the special report on the Bourne Flow, as it is generally called, just issued by the Borough Engineer of Croydon. This stream, which appears so irregularly, is about the sole survivor of many which used to burst forth periodically from the chalk hills of Surrey and flood the Croydon Valley. The rest have apparently succumbed to the exigencies of modern drainage and the demands of the water companies. The Bourne is commonly attributed to the flooding of underground water channels; and it is pointed out that there was a heavy rainfall during the summer and autumn of last year. The rain-gauge at Purley showed an excess over the corresponding five months of 1911 of more than 6 inches. The Bourne now flows more quickly down the valley than formerly, owing to the construction of new culverts and impervious channels during recent years. The Borough Engineer regards this as improper—believing that the water should have every opportunity of percolating into the ground.

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Nelson Gas Department.—The accounts of the Gas Department of the Nelson Corporation for the year ended the 31st of March last, a copy of which we have received from the Engineer and Manager (Mr. A. Morton Fyffe) show that the gross profit was £21,890, and the net profit £8891. This was transferred to the gas revenue appropriation account, and was subject to appropriations amounting to £6391; leaving a surplus of £2500. Mr. Fyffe's report was noticed at length in the "JOURNAL" for the 29th of April last (p. 347).

Increased Water Storage at Porthcawl.—A new service reservoir, which has been constructed in connection with the water-works of the Porthcawl Urban District Council, was opened on the 1st inst. by Mrs. Jones, wife of Mr. T. G. Jones, the Chairman of the Council. The reservoir is situated at Tycoch, 1½ miles from the town. It has a holding capacity of a million gallons, or sufficient to supply the town for ten days, and meet the requirements of 35,000 inhabitants. The cost was about £5000. The Engineers of the scheme were Messrs. John Taylor, Santo Crimp, and Co.

Leatherhead and District Water Company.—At the meeting of this Company on the 1st inst., the Directors reported that the receipts for the half year ended June 30 amounted to £5059, and the expenses to £2523; leaving a profit of £2536. To this must be added £932 brought forward; making a total of £3468. Deducting the interest on the debenture stock, there remained £3200 available for distribution; and the Directors recommended dividends at the rates of 10 per cent. per annum on the original shares and 7 per cent. per annum on the remainder of the shares. These absorbed £2149, and left a balance of £1051 to be carried forward.

Housing Workmen during Reservoir Construction.—At the closing sitting of the House last Friday, Mr. Keir Hardie asked the President of the Board of Trade whether he had any information in regard to the housing which is being provided for the workmen who are, or are about to be, employed in the construction of the Taff Fechan reservoir; and whether, in view of the scarcity of house accommodation in the neighbourhood, he would cause special observation to be made to prevent overcrowding while the works are in progress. Mr. Burns, who had been asked to reply to the question, said he had just received a report from one of his Inspectors, who visited the works referred to ten days ago. He stated that there was ample accommodation for all the men at present employed, or who were likely to be employed in the immediate future. He promised to continue to have the matter kept under observation as long as the works are in progress.

Electric v. Gas Lighting in Hastings Schools.—A proposal to substitute electric light for gas in Hastings schools was recently adopted by the Education Committee of the Corporation—not, however, without some protest by five members—who made out that the cost would not be more than is now paid for gas. In a letter to the "Hastings Observer," Mr. A. Turner characterized the vote as wasteful. "Let us," he said, "increase the sale of current as much as possible; but to run the ratepayers into a cost of £174 15s. to provide the small amount of light required by the caretakers (for this is what it practically amounts to) is nothing but waste of money. Had the proposal been for a rise of a shilling or two in the caretakers' wages, it would promptly have been thrown out, on the score of economy." The writer trusted the ratepayers would bear this in mind when the men who voted this waste were asking for support at the election.

South Hants Water Company.—At the half-yearly meeting of this Company held recently, the Directors reported that the profit and loss account on the 30th of June showed a credit balance of £11,132, from which it was decided to pay an interim dividend for the past six months at the maximum rate on each class of ordinary shares. Regret was expressed at the decease of Mr. Easton Devonshire, a Director of long standing. The Bishop's Waltham Water Bill, which enabled the undertaking of the Bishop's Waltham Water Company to be transferred to the South Hants Company, had, the Directors were pleased to say, received the Royal Assent. At a subsequent extraordinary general meeting, the Directors were authorized to raise additional capital, under the Act of 1910, to the amount of £30,000, and also to issue £11,250 of 4 per cent. debenture stock; being £6250, the balance remaining under the Act of 1899, and £5000 under the Act of 1910.

Water Supply in the Field.—This was the subject of a paper read by Captain-Surgeon Dr. Zoltan de Ajkay, of the Hungarian Army, in the Bacteriology Section of the recent Congress of Medicine. He pointed out that this important problem had not been solved. Neither by the addition of chemicals nor by filtration could the necessary standards of purification be achieved. The most recently introduced discoveries in the use of ozone and ultra-violet rays still presented great mechanical difficulties when it came to a question of actual field work. On the other hand, the boiling of the water in a portable apparatus could easily be carried out in the field. Colonel Horrocks spoke highly of the method at present being tried at the Royal Army Medical College, in which a combination of chemical means and filtration is resorted to. The chemical used is bleaching powder; and filtration is effected through a thick cloth on which a scum is formed as a result of the addition of alum to the water. Chemical methods were highly spoken of from experience in campaigns in North Africa.

Widnes Gas-Works Extensions.—A Local Government Board inquiry was held at Widnes last Wednesday into the application of the Corporation for sanction to borrow £36,000 for the extension of the gas-works. Mr. T. Craik, the Deputy Town Clerk, said the object of the extension was to further reduce the cost of the manufacture of gas, and it was hoped that the present prices of 9d., 11d., and 1s. 1d. per 1000 cubic feet, which were believed to be for lighting purposes 20 per cent., and for power purposes 25 per cent., less than those charged in any other place, would be still further reduced. Mr. Isaac Carr said he had been the Gas and Water Engineer of the Corporation for 31 years. Thirty years ago, the output of gas was 62 million cubic feet; whereas last year it was 453 millions. The proposed extensions were necessitated by the great increase in the consumption of gas last year. At present they could make 2 million cubic feet per day; but last year the daily consumption was 1,552,000 cubic feet. This left very little latitude; and they had either to build new works or face the disaster of a short supply.

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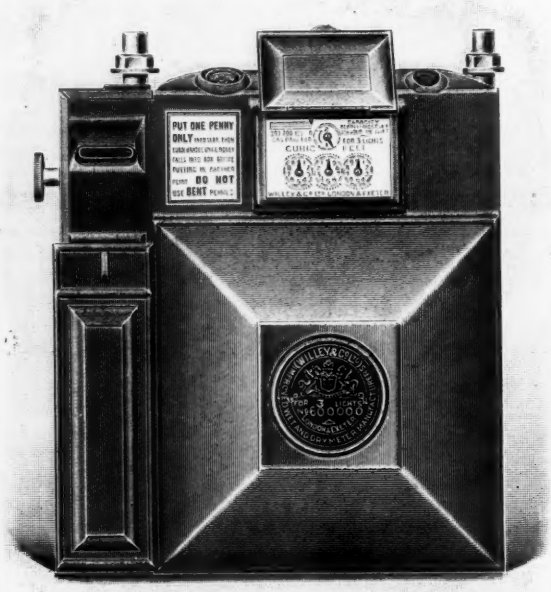

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Cardiff Corporation Water Undertaking.—The past year's receipts from water and meter rentals, after allowing £1266 for empty houses, irrecoverables, &c., totalled £73,244, or an increase of £1303 over the previous twelve months. The rate-in-aid from the general district fund for the water-works account for the past year amounted to £7528; and, judging by the figures for the last five years, the tendency is for the annual call upon the rates to increase.

West Surrey Water Company.—The accounts of this Company for the six months ended the 30th of June, which were presented at the half-yearly general meeting last Tuesday, showed that the income amounted to £8631, and the expenditure to £3321. A sum of £7119 was available for distribution; and dividends on the ordinary shares at the maximum rates of 7 and 10 per cent. per annum were declared. These, with the dividends on the preference shares, absorbed £4370, and left a balance of £2749 to be carried forward.

Brighton and Hove Gas Company.—At the half-yearly general meeting of this Company next Friday, the Directors will report that, compared with the results for the six months ended June 30, 1912, the sale of gas in the past half year increased by 22,083,900 cubic feet, or 3·2 per cent., and the revenue from residual products by £4195. The profits amount to £32,126, to which is added £39,291 brought forward; giving a total of £71,417. After charging income-tax and interest on debenture stock, and appropriating £1800 to the capital redemption fund, £66,102 is available for distribution. The Directors recommend the declaration of dividends for the half year at the statutory rates per annum as follows: 6 and 4 per cent. on the "B" and "C" preference consolidated stocks, and 11 and 8 per cent. on the original and "A" ordinary consolidated stocks. This appropriation will require £23,379, and leave a balance of £42,723 to be carried to the credit of the profit and loss account for the current half year. Before arriving at the profits previously mentioned, an appropriation of £1454 was made in favour of the benefit fund account for weekly employees, pursuant to the provisions of the Brighton and Hove Gas Act, 1912.

Tunbridge Wells Gas Company.—Some items of interest that transpired at the recent half-yearly meeting of this Company were: Coal in the six months, January to June, cost £2200 more, of which £1300 was for the additional quantity used. Their carburetted water gas plant required only 84,000 gallons of oil, compared with 97,000 gallons in the same six months of 1912; and yet the cost was £250 more. The cost of the carbonizing materials used during the past half year was about £3700, and the increased cost of gas per 1000 cubic feet in the holders, after allowing a very satisfactory result on the residual profits, was 3¼d. Coke had produced £600 more than in the corresponding half of last year, and tar £350 more; while breeze had also increased, and the sulphate of ammonia showed a very satisfactory increase of something over £300. Yet the actual cost of gas had increased the 3¼d. named. There had been a very good increase in the amount of gas sold—about £720 in the gas-rental; and this amounted to nearly 4¼ per cent. on the quantity sold. The demand for gas was increasing. The number of stoves out on hire had very considerably increased as compared with what it was at Christmas. The percentage of the total sale of gas for public lighting, which used to be 5 per cent., was now about 1⅜ per cent. The number of public street lamps (including a few at Southborough) was last year 462, but was now 440, and after the termination of this year it would be reduced still further. Coke had fetched a good price, making about 3d. a ton more than last year, and it was now at a very satisfactory figure. The Company had a balance of about £15,000 carried forward.

APPLICATIONS FOR LETTERS PATENT.

17,807.—Sperryn, G. N., "Gas-lamps." Aug. 5.
17,809.—Severin, L., "Securing bells, globes, and chimneys to lamps." Aug. 5.
17,819.—Sadler, C. J., "Quenching, screening, and loading coke." Aug. 5.
17,849.—Mollett, J. N. (Mrs.), "Shade or globe supports for gas lights." Aug. 5.
17,854.—Pace, P. C., "Manufacture of air gas." Aug. 5.
17,877.—Athion G. M. B. H., "Purifying gases and obtaining useful products therefrom." Aug. 5.
17,902.—Worsfold, J., and Smith, A. J., "Inverted gas-lamps." Aug. 6.
17,927.—Siemens Bros. and Co., Limited, "Optical pyrometers." A communication from Siemens and Halske Akt.-Ges. Aug. 6.
17,944.—Rigby, T., and Wetcarbonizing, Limited, "Utilization of peat." Aug. 6.
17,945.—Boberg, J. A., "Lighting gas-stoves." Aug. 6.
17,956.—Siemens, F. K., "Regenerative gas-furnaces." Aug. 6. [Addition to No. 10,824, of 1912.]
17,972.—Harmer, C. W. T., "Gas-filter for blowpipes." Aug. 7.
18,014.—Moeller, J., "Furnaces and cupolas." Aug. 7.
18,025.—Brown, W. J., Davies, W., Richards, W. W., and Tucker, W. H., "Valves for gas-furnaces." Aug. 7.
18,033.—Muers, P., "Burners and burner fittings for furnaces." Aug. 7. [Divided Application on No. 11,036 of 1913. May 9.]
18,039.—Coventry, W., "Mantle holders for incandescent gas-burners." Aug. 8.
18,043.—Levack, A. R., "Glass globe or shade holder." Aug. 8.
18,094.—Chandler, D., and The South Metropolitan Gas Company, "Inverted Incandescent gas-lamps." Aug. 8.
18,107.—Street, C. J. C., "Gas-turbines." Aug. 8.
18,149.—Thomsen, P. F., Luii, J. A., van Dam, W. J., and Lasschuit, P. T. A., "Regulators for the supply of air and gas to burners, gas-cookers, and gas-stoves." Aug. 9.
18,150.—Thomsen, P. F., Luii, J. A., van Dam, W. J., and Lasschuit, P. T. A., "Burners for gas-cookers, gas-boilers, geysers, &c." Aug. 9.
18,168.—Fabriques de Produits Chimiques de Thann et de Mulhouse, South Metropolitan Gas Company, and Georges Freyss, "Manufacture of hydrocyanic acid." Aug. 9.
18,173.—Robin, J. I., "Incandescent gas-mantles." Aug. 9.

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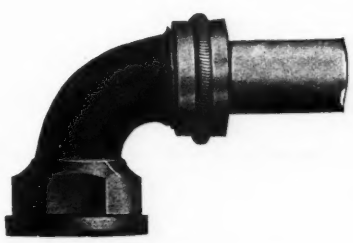
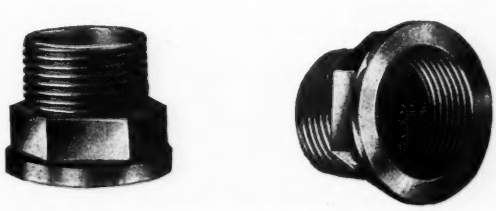


STOVE BEND No. 112.

STOVE BEND No. 111.



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It is reported in Berlin that the German Welsbach Company have taken up a new branch of industry—the manufacture of refrigerators. The Company have obtained a patent for a new type of apparatus, and, according to all accounts, they are preparing to manufacture them in large quantities.

The Ossett Town Council have decided to proceed with an application to the Local Government Board for permission to borrow £40,000 for future extensions at the gas-works. In connection with the proposed extensions, we learn that they have provisionally accepted a tender submitted to them by the firm of Messrs. Leech, Goodall and Co., amounting to £18,074, for the supply of a Dessau vertical gas-retort installation.

Messrs. George Bray and Co., of Leeds, are experimenting in working earlier hours—having arranged for their thousand odd workpeople to commence at seven o'clock in the morning instead of eight, and finish at five in the evening instead of six. The Saturday closing hour is twelve o'clock noon, instead of one. The change has been greatly appreciated by the workpeople; the only material disadvantage appearing to be the fact that the postal deliveries at the men's homes are later than the time at which they have to leave for their work, and they, consequently, do not receive their letters before mid-day or evening.

"Chimney sweeps are not wanted nowadays, owing to the use of gas and electricity," said a chimney-sweep debtor a few days ago at the Clerkenwell County Court. Mr. Jenkins, a member of the firm who sweep the King's chimneys, last Thursday confirmed this complaint. "It is generally admitted," he said, "that the trade of the chimney-sweep is doomed, like that of the hansom-cab driver. Most of the new large buildings are supplied with central heating apparatus from hot-water boilers. In private houses, old and new, gas-fires are taking the place of coal-fires, especially in bedrooms and rooms which are not used continuously. In some hotels, the bedrooms have no fireplaces at all."

The Oswaldtwistle Urban District Council recently decided to instal forty-two of the "A. and M." patent lighting and extinguishing apparatus, together with the Alder and Mackay hurricane proof copper lantern.

At the Royal Sussex County Hospital, Brighton, last Friday, the death occurred of William Moon, a night watchman, of Brighton. Moon was engaged at Lancing (some six miles from Brighton) by the Brighton and Hove Gas Company, and while extinguishing some lamps early one morning his clothes caught fire. He was unable to extinguish the flames, and was terribly burnt.

The trading departments of the Burton-upon-Trent Corporation took full advantage of the advertising value of the flower show held last week, and at the Market Place end of the industrial tent the Gas Department had a representative display of the best modern appliances for the use of gas in the home and the place of business. It included gas-fires by the Richmond Gas Stove and Meter Company, Limited, and Messrs. John Wright and Co., the "Garajo" and "Sun" boilers, the "Hotwell" lavatory water-heater, and a Crossley 7 B.H.P. gas-engine. Information was afforded by Miss Henley and her staff of attendants; and also by Mr. Newman, the outdoor foreman.

Last Wednesday week, a large party consisting of members of the Tunbridge Wells Tradesmen's Association visited the works of the Gas Company, where they were received by the Directors, the Engineer and General Manager (Mr. A. Dougall, M.Inst.C.E.), and the Secretary (Mr. C. F. Catt). Under the guidance of Mr. Dougall and his assistants, a comprehensive tour of the works was made; the visitors being initiated into the interesting and instructive process of gas manufacture and its allied industries. At the close Alderman W. H. Delves, the Chairman of the Company, expressed his pleasure in welcoming the visitors. Mr. D. H. Murton-Neale, the President of the Association, proposed a vote of thanks to the Directors for their hospitality, coupling with the vote the name of Mr. Dougall, who had, he said, so kindly and ably conducted the party.

GAS COMPANIES' STOCK AND SHARE LIST.

Generally speaking, the Stock Exchange had a satisfactory week in that just completed. A growing consolidation of confidence, or at least of firm hopefulness, became more and more apparent as day succeeded day without bringing forth incidents either at home or abroad calculated to inspire apprehension. Progress in the Balkans was certainly slow; but the absence of any fresh disturbing factor was a gratifying feature. At home, a noteworthy point was the brighter aspect of the Railway world; and its market cheered up accordingly. Other departments also participated in a greater or lesser degree. It goes without saying, however, that business in mid-August was not overabundant; but there was no evidence of weakness arising from lack of support. It was account week, too, and the settlement apparently involved no difficulties. On the opening day, the tone was only moderate, and was inclined to vary. Government issues were scarcely as strong as they had closed on Saturday, and Consols ruled easier. Rails were inactive and gave no certain sign; American steadied before the close; and Foreign were fair on the whole. Tuesday brought a considerable improvement in tone; and with the brighter tendency came some acceleration of business. Easy money promised to smooth the passage of the settlement. Government issues, doubtful at first, strengthened materially later on, and Consols more than recovered their lost ground. Rails were quite cheerful, supported by good buying. Americans were buoyant; and Foreign showed strength. On Wednesday, the aspect of affairs affecting this country being favourable, markets became quite cheerful, and some of them almost active. Gilt-edged were very firm, Consols advanced, prices of rails advanced freely, and the rest sympathized. Thursday was quieter, and the buoyant tone weakened towards the close; but Consols did not move. Friday was quieter still, and the tone was not so strong. Some impatience with Balkan affairs was felt; so that markets were not so strong. On Saturday, there was not enough doing to create any pronounced tone. Consols closed 73⅝ to 73¼—a rise of ⅛ in the week. The Money Market was steady without tightness. Business in the Gas Market was not very active, but the tendency was quite firm. In Gaslight and Coke, the ordinary marked 103¾ to 104¼ *cum div.*, and 101⅝ to 102⅛ *ex div.* In the secured issues, the maximum made 77 and 77⅜ *cum div.*, and 75½ and 75⅝ *ex div.*, the preference 96¾ *cum div.* and 94⅞ and 95 *ex div.*, and the debenture 73½ and 74. South Metropolitan realized 111¾ and 112 *cum div.*, and 109½ and 109¾ *ex div.* Commercial 4 per cent. fetched 105½. Among the Suburban and Provincial group, nothing was done. In the Continental companies, Imperial made 163½ to 164½, Union 80, ditto preference 124½, and European 18½. Among the undertakings of the remoter world, Hong Kong changed hands at 17½ and 17⅝, Monte Video at 12½, Primitiva at 6⅜ to 6 7/16, and ditto preference at 5 1/16 to 5 1/16.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 11	5	Alliance & Dublin Ord.	63–68	−2	7 7 1
874,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5
280,000	5	April 11	7½	Bombay, Ltd.	6½–6⅞	..	5 11 1
50,000	10	Feb. 27	15	Bourne- mouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c.	28½–29½	..	5 1 8
347,500	10	,,	7		15¼–15⅝	..	4 8 11
75,000	10	,,	6		13⅞–14¼	..	4 4 3
880,000	Stk.	Aug. 14	14	Brentford Consolidated	258–263*	+3	5 6 5
330,000	,,	,,	11	Do. New	195–200*	+½	5 10 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113*	+½	4 8 6
206,250	,,	June 13	4	Do. 4 p.c. Deb.	92–94	..	4 5 1
217,380	Stk.	Feb. 27	11	Brighton & Hove Orig.	206–211	..	5 4 3
244,200	,,	,,	8	Do. A Ord. Stk.	151–154	..	5 3 11
530,000	20	Mar. 28	12½	British	45–46	..	5 8 8
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	83½–91½	..	4 7 5
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	4–5	..	—
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	107–109*	..	4 11 9
1,513,380	Stk.	Feb. 27	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1
660,000	,,	,,	5½	Do. 3½ p.c. do.	102–104	..	5 2 6
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	69–71	..	4 4 6
800,000	Stk.	,,	4	Continental Union, Ltd.	80–83	..	4 16 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	124–126	..	5 11 1
492,270	Stk.	—	5	Derby Con. Stk.	—	..	—
55,000	,,	—	4	Do. Deb. Stk.	—	..	—
1,002,180	10	July 30	10	European, Ltd.	17¼–18¼	+¼	5 9 7
16,386,660	Stk.	Aug. 14	4/17/4	Gas- light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref.	101–103*	+1⅛	4 14 6
2,600,000	,,	,,	3½		74–77*	+⅜	4 10 11
4,062,235	,,	,,	4		93–96*	..	4 3 4
4,674,850	,,	June 13	3	Coke { 3 p.c. Con. Deb.	73–75*	+½	4 0 0
258,740	Stk.	Mar. 13	5	Hastings & St. L. 3½ p.c.	83–91	..	5 9 11
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	April 25	11	Hongkong & China, Ltd.	17–17½	..	6 5 9
131,000	Stk.	Mar. 13	7⅜	Ilford A and C	152–155	..	4 18 4
66,780	,,	,,	6⅜	Do. B	120–122	..	5 0 5
65,500	,,	June 27	4	Do. 4 p.c. Deb.	87–89	..	4 9 11
4,940,000	Stk.	May 16	9	Imperial Continental	162–167	..	5 7 9
1,335,000	Stk.	Aug. 14	3¼	Do. 3½ p.c. Deb. Red.	83–85*	..	4 2 4
200,242	Stk.	Mar. 13	£½†	Lea Bridge Ord. 5 p.c.	121–124	..	5 0 10
561,000	Stk.	Feb. 27	10	Liverpool United A	207–209	−1	4 15 8
718,100	,,	,,	7	Do. B	145–147	−1½	4 15 3
306,083	,,	June 27	4	Do. Deb. Stk.	96–98	..	4 1 8
63,480	Stk.	June 27	3	Maidstone 3 p.c. Deb.	66½–68½	..	4 7 7

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	June 13	6	Malta & Mediterranean	4⅜–4¼	..	6 3 1
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	98–100	..	4 10 0
541,920	20	May 30	4	Monte Video, Ltd.	12⅝–13	..	6 3 1
1,775,892	Stk.	July 20	4½	Newc'tle&G'tesh'd Con.	97–97½	..	4 12 4
629,705	Stk.	June 27	3⅜	Do. 3½ p.c. Deb.	83½–84½	..	4 2 10
55,940	10	Feb. 27	7/7/0	North Middlesex 7 p.c.	13–14	..	5 4 7
800,000	Stk.	May 16	8	Oriental, Ltd.	124–129	..	6 4 0
60,000	5	Mar. 28	10	Ottoman, Ltd.	6½–6⅝	..	5 14 3
60,000	50	Aug. 14	13	Portsea, Island B	122–125*	..	5 6 1
100,000	50	,,	12	Do. C	119–122*	..	4 18 4
249,980	5	May 16	8	Primitiva Ord.	6–6⅛	+⅛	6 3 1
499,960	5	June 27	5	,, 5 p.c. Pref.	5–5⅛	..	4 15 3
521,600	100	June 2	4	,, 4 p.c. Deb.	93–95	..	4 4 3
846,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	90–92	..	4 7 0
275,000	5	Apl. 11	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11½–11⅝	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	48–50	..	5 0 0
135,000	Stk.	Mar. 13	10	Sheffield A	225–227	..	4 8 1
209,984	,,	,,	10	Do. B	225–227	..	4 8 1
523,500	,,	,,	10	Do. C	223–225	−1	4 8 11
90,000	10	May 30	7½	South African	9½–10½	..	7 2 10
6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	102–110*	+2	4 19 4
1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	72–74	..	4 1 1
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	157–159*	..	5 6 11
952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	115–117*	+1	5 2 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115*	+½	4 6 11
117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
694,740	Stk.	May 16	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Aug. 14	7⅜	Tottenham and { A 5 p.c. B 3½ p.c.	136–139*	+⅜	5 6 1
513,940	,,	,,	5⅜		113–115*	+½	5 2 2
149,470	,,	June 27	4	Edmonton	94–98	..	4 7 0
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	94–96	..	5 4 2
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	112–113*	..	4 8 6
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	..	8⅜†	Wandsworth A 5 p.c.	160–165	..	5 1 6
255,836	,,	..	6⅞†	,, B 3½ p.c.	132–137	..	5 0 4
108,075	,,	..	5/17/3†	,, C 3½ p.c.	113–118	..	4 19 6
352,000	,,	..	6⅛†	Wimbledon 5 p.c.	110–115	..	5 6 6
98,000	,,	..	6⅜†	Epsom 5 p.c.	117–122	..	5 8 7
88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9

Prices marked * are "Ex-Div." † Next Dividend will be at this rate.